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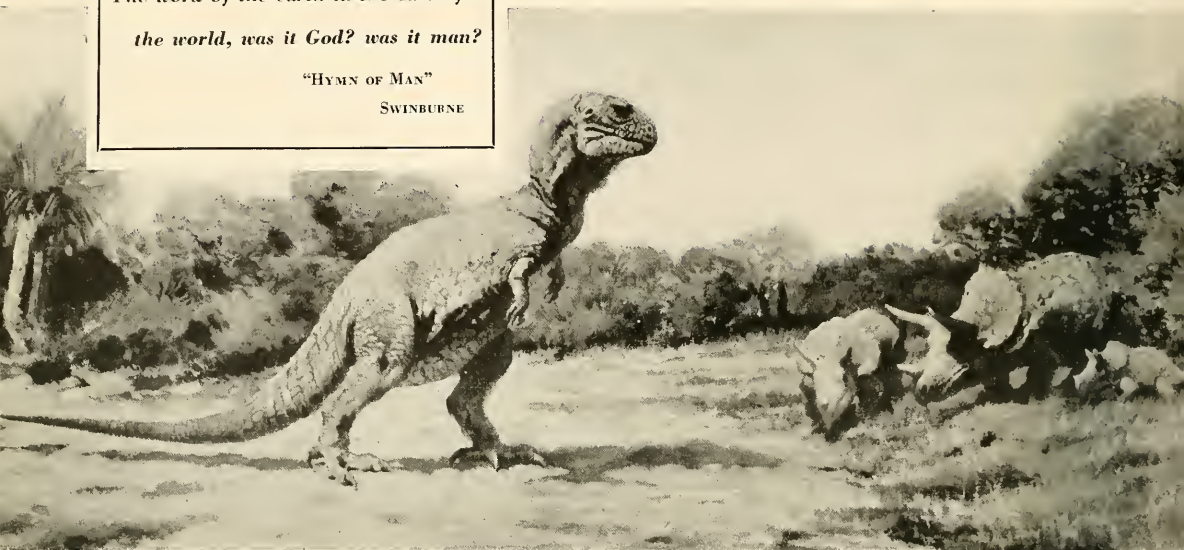
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the world, was it God? was it man?*

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THE AMERICAN MUSEUM OF NATURAL HISTORY

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The Value of Pure Research

IN an earlier issue we have attempted to show how the vigor and validity of museum teaching, in common with higher education in general, depends on continued original research by the educator. To the extent that our research is defined by this relationship and can be described as "teacher exercises," the precise aim of any particular investigation is immaterial. The questions frequently asked about the usefulness of the information obtained miss the main point, because the usefulness springs from the simple fact that the methods of original research are being followed. However abstruse the problem a scientist may choose to examine, he is not able to produce an answer which will stand up under criticism unless he keeps himself abreast of advancing knowledge in his entire field. Nor will he be able to come to any conclusions at all without exposing himself to a continual process of learning through his work. His knowledge will be kept up to date and his personal awareness of educational experience will be kept alive.

Nevertheless let us also immediately establish that any research intelligently done is always useful, if only for the reason that ignorance is always dangerous and any addition to our knowledge therefore reduces the hazards of our existence and increases the security of our welfare and our progress. This may sound as if we were begging the question, but there are very few scientists who could not quote numerous examples to illustrate the point. One might think of hun-

dreds of well-planned efforts which failed because "useless" information about the uselessness of the attempt was not available in advance. Strategy which was unsuccessful due to ignorance about the habits of certain birds. One might also tell of materials and efforts saved at a time when we could ill afford to waste them, because the wasteful outcome of a proposed enterprise could be clearly determined in advance from our body of "useless" knowledge. It is often just as important to know the things which are not as to know the things which are. One of the most striking lessons learned from this war is that it is not given to any man to judge the ultimate usefulness of any knowledge whatsoever and that no one should attempt to pass such judgment.

Among the oldest and most logical research functions of a museum is the task of providing a scientific classification of the objects and substances of nature. And it is in the pursuit of this duty that the museum most often finds itself exposed to the ridicule of the uninformed. Again we find a defensive over-emphasis upon trifles, developed in response to the scorn of the unthinking, as when the discovery of a new species is triumphantly announced as a major achievement. And yet it is only through the sum of these discoveries that the foundations are built for the practical exploitation of any natural resource. And it is only by the meticulous and seemingly insignificant work of classification that a system is created by which practical as well as scientific experience can be

reliably recorded and compared, so that new uses can be found and new discoveries made.

From centuries of accumulation of apparently useless information systematic research has endowed every new branch of applied science with a heritage of classified knowledge in which the possibilities of practical utilization are revealed, and without which a starting point for exploitation would rarely have been found.

The mining engineer searching for new sources of previously unused chemicals will find what to look for in the records and collections of generations of mineralogists who built our knowledge without concern for its immediate usefulness. Agriculture, in its struggle against the pests destroying our crops, and Medicine, in its fight against animal carriers of disease, owe their knowledge of the enemy to the refined methods of identification developed by two centuries of quiet museum research into the classification of animal life. The list could be extended into the infinite.

The unknown can obviously not be evaluated in advance, and all knowledge ultimately seems to find a use, if only by avoiding the errors of ignorance. Let us therefore grant the necessity for maintaining research institutions which, for the ultimate good of all, must not be required to orient their search for new knowledge solely on the basis of any predictable immediate usefulness. In the field of the natural sciences the museums are the logical institutions to play this role.

A. G. Barr
Director, The American Museum
of Natural History.

THE SEARCH THAT NEVER ENDS



IN THE industrial life of America, research has been of constantly increasing importance. And today it is a national resource, for the research of industrial and college laboratories is proving its value in War.

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industrial laboratory in the world. And it exists to improve telephone service.

Improvements in industry can be left to chance in the hope that some one, sometime, will think of something useful; that some good invention will turn up.

The other way to make improvements is to organize so that new knowledge shall always be coming from researches in the fundamental sciences and engineering arts on which the business is based. From that steady stream will arise inventions and new methods, new materials and improved products.

This is the way of Bell Laboratories. Its search will never end. And as fast as it can the Laboratories will apply its new knowledge practically to the design of equipment and communication systems.

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

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JANUARY, 1944

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YOUR NEW BOOKS

BIRD WATCHING • NUSANTARA • GALAXIES
SALAMANDERS • TREASURY OF SCIENCE

A GUIDE TO BIRD WATCHING

----- by Joseph J. Hickey
Oxford University Press, \$3.50

THE modern technique of bird watching is of comparatively recent development. Early field ornithology was concerned more with collecting specimens than with collecting observations. True, the collector was advised wholeheartedly to record his observations, but there was little advice on what to look for. Those unable or unwilling to shoot birds often found their interest short-lived if confined to making daily lists of species seen, but they could find no broader prospect. Had they but known it, the field was almost unlimited.

Nevertheless, there have always been some who could find absorbing problems at their doorsteps, and as the science has developed, the possibilities for study have become increasingly clearer and more obvious. This is what Mr. Hickey has portrayed in his book. Beginning with the "daily list" with its necessity for identifying the birds and their songs, there are the questions of migration and other dispersal, homing, censuses, bird banding, ecology, sex ratios, and a multiplicity of fine details of life history, to mention but some of the things that we still need to know in respect to many, if not most, of our common birds. The opportunities for original discovery are far beyond the limitations of any lifetime.

Mr. Hickey's careful analysis of the problems and his suggestions for work to be done should be of the greatest service. With this book as a guide, no one with an interest in birds should remain in doubt as to how best to spend his time afield. The text is well organized, and the frequent pertinent narrative makes the volume one to be read as well as kept at hand for frequent reference. An interesting novelty is introduced with a series of shorebird tracks, with a key, collected by the late Charles A. Urner. Numerous fine vignettes by F. L. Jaques add to the attractiveness of the book.

J. T. ZIMMER.

ICELAND AND GREENLAND

----- by Austin H. Clark
Smithsonian Institution

THIS volume, Number 15 in the series "War Background Studies," is to be

recommended to all readers who wish a brief and concise yet well rounded study of these two countries and their inhabitants. Each is treated in a separate section divided into discussions of geography, climate, geology, fauna, flora, etc. The portions devoted to history make it clear why the two countries have been discussed in one volume, for historically, if not in other respects, they are closely bound together.

The preparation of such a work under the stress of limited time must have been difficult. Specialists in the various subjects treated may note omissions or wish for different treatment, but the general purpose of the series has been achieved. A more leisurely preparation would have permitted the section on the geology of Greenland to have been brought up to date, and perhaps a more helpful presentation of references might have been worked out. One can but hope that in more normal times the series will be continued as "A Background for Peace," a more appropriate caption.

JUNIUS BIRD.

THE LEANING WIND

----- by Clifford Gessler
D. Appleton-Century Co., \$3.00

IN the prewar days of the middle 30's Clifford Gessler abandoned his newspaper job and signed on as a member of the crew of the *Islander*, a sampan employed by a group of Bishop Museum scientists in a scientific survey of eastern Polynesia. The distillation of that voyage is now wafted to us in *The Leaning Wind*. The itinerary of the expedition formed a huge loop beginning and ending at Honolulu, but threaded thereon were countless islands, large and small. The voyagers, scientific and otherwise, visited the coral rims of the Tuamotus, melancholy Mangareva, the descendants of the mutineers

of the "Bounty" on Pitcairn, Rapa (the sailor's delight), the neat Australs with their coral houses, the bounteous Society Islands, and many other lesser known fragments scattered in these seas. The collecting of snails, insects, plants, and native lore constituted the purpose of the expedition, and one gathers that this aspect of the trip proved eminently satisfactory. The author, however, is more concerned with the extra-curricular phases of the voyage and relates them in a charming and poetic narrative which often becomes more the evocation of a mood than an intellectual analysis of Polynesian life.

H. L. SHAPIRO.

NUSANTARA

A History of the East Indian Archipelago

----- by Bernhard H. M. Vlekke
Harvard University Press, \$5.00

WHEN, in 1942, the reviewer undertook a survey of Southeast Asiatic studies at American universities and colleges, replies to questionnaires again and again complained about the lack of a comprehensive history of the East Indies in the English language. Steiger's *History of the Far East* devotes only relatively little space to the archipelago. De Klerck's *History of the Netherlands Indies* treats very little except the Dutch colonial period. Since this book was published in Holland, it is not easily procurable. It is therefore very gratifying that the need so strongly felt by American educational institutions should have been met so soon.

By choosing for a title a Javanese name for the Malay Archipelago, the author already implies that his book is not solely devoted to the history of Dutch rule. He starts with a short—in the reviewer's opinion somewhat too short and too generalized—survey of the prehistory and anthropology of the islands. The Hindu period as well as that of Mohammedan and Portuguese rivalry are well and interestingly treated. The bulk of the book is very naturally concerned with the period of Dutch rule. The chapter on "The Birth of a Nation," treating the various nationalist movements, will be especially welcome to all those who seek information on the political and social problems of the region, so important from the point of view of future developments. The last chapter gives an outline of the political and military events from the invasion of Hol-

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land by the Germans to the occupation of the East Indies by the Japanese.

The book is excellently written, clear, critical, and unbiased. Especially so far as the Hindu period is concerned, it makes the results of research by Dutch scholars available for the first time to the English reading public. The notes supply a very good choice of literature for those who want to go deeper into the subject.

ROBERT VON HEINE-GELDERN.

COVERTS AND CASTS

----- by William J. Schaldach

S. A. Barnes & Co., \$5.00

I AM not given to superlatives but, if I had received *Coverts and Casts* as a Christmas present, I would not have been just pleased but delighted. This is not merely another book to read but a classic for the enjoyment of real sportsmen, their families and friends, and for all those who love hunting and fishing. It is for those to whom the whirr of partridge wings, the fall leaves and the setting sun, or the murmuring brook and the rising trout mean more than an overstuffed game bag. It covers, as the inscription on the jacket states: "a field of sports and angling in words and pictures." These pictures, none of which has been previously reproduced, are not mere illustrations in black-and-white and color, but life portraits that bring home the story of sport in the field and stream more vividly than can be expressed in so many words.

This is not a book of instructions. Its pages are full of valuable information gleaned from experience, and it will recall many incidents from the reader's own days afield. I remember a few years ago landing by plane on a glacier lake on the border of the Yukon. My companion, an experienced fisherman of long standing, unsuccessfully tried everything but had to learn that those fish simply were not educated to his standard. A hunk of raw meat half as big as my fist on a large hook and a heavy line landed me a 16-pound trout. Unorthodox, you may say, but we ate.

Mr. Schaldach is widely known for his outdoor etchings and water colors, and his works are highly prized by many collectors. Since his school days he has been interested in angling and gunning and has hunted and fished in many states from Minnesota through New England to the Province of Nova Scotia. The volume contains 138 pages, printed in easy type and written in an attractive manner.

GEORGE G. GOODWIN.

GALAXIES

----- by Harlow Shapley

The Blakiston Co., \$2.50

THIS, the sixth volume of the new Harvard Books on Astronomy, was written by the Director of the Harvard College Observatory. Doctor Shapley refers to Dr. Edwin P. Hubble of Mount

Wilson as the leading student of galaxies. On the other hand, it is quite certain that Doctor Hubble, author of the classic work on the galaxies, *The Realm of the Nebulae*, would recognize in the present little book by his colleague a most excellent and the most up-to-date discussion of the subject. In fact, it is an open question as to which of these astronomers has done more to solve the problems of these gigantic systems of stars.

With his facility of lucid expression and his ability to make fascinating to the man in the street the most abstruse problems of astronomy, Doctor Shapley has given us in a few brief chapters the history and progress of our knowledge of this vast subject.

In the first chapter he discusses the unfolding of the conception of our own Milky Way Galaxy, the progress in measurement of distances to the stars, and the kinds of galaxies. Chapter Two consists of a treatment of the Star Clouds of Magellan and the recently discovered stellar bridge between the two. In Chapter Three is explained the epoch-making discovery of the period-luminosity relation and its use as a yardstick in galactic measurements. Chapter Four is devoted to the Milky Way as a galaxy; Chapter Five to the neighboring galaxies; Chapter Six to the Metagalaxy, which is the name that Doctor Shapley applies to "the all-inclusive system of galaxies, clusters, nebulae, stars, planets, interstellar gas and dust, and radiation." Chapter Seven, the last in the book, is a discussion of the Expanding Universe.

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By BERNARD H. M. VLEKKE

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superb photographs by the Mount Wilson, Lick, and Harvard Observatories; and scattered through the text are portraits of a score of astronomers who have contributed in significant ways to the progress of our knowledge of the galaxies.

CLYDE FISHER.

THE NEW WORLD GUIDES TO THE LATIN AMERICAN REPUBLICS

----- edited by Earl Parker Hanson

Volume One: Mexico and Central America

Volume Two: South America

Duell, Sloan, and Pearce, Each Volume
\$2.50

ATTENTION has been critically focused on the activities of the Office of the Coordinator of Inter-American Affairs. One of the many projects undertaken with the aid of that office has been the preparation of these two fine volumes. They bring together a vast amount of data and will reach a much wider audience than such unquestioned and much more restricted standard government publications as the *Coast Pilot* series of the United States Hydrographic Office. The fact that a commercial publisher was willing to undertake publication is one index in purely economic terms of the value of these two volumes.

The information compiled in these guides is far more complete than, for instance, the commercial British South American guidebook, which does not cover Central America and is much more limited in scope. Each country is treated separately, following a definite plan. General comments are brief and to the point and are followed by sections on History, Art and Architecture, Practical Information, and Regional Guides, with most of the text devoted to the last. The usefulness of the whole is greatly facilitated by having separate indexes for each country.

Various authorities have contributed different sections and, as the editor was fully aware, a small percentage of errors is to be expected in a work of this type and size. These volumes, together with the new American Geographical Society Maps, also sponsored by the Coordinator's Office, should be available in all our libraries and should be carried by all travelers and tourists in Latin America.

GORDON F. EKHOLOM and JUNIUS BIRD.

HANDBOOK OF SALAMANDERS

----- by Sherman C. Bishop

Comstock Publishing Company, \$5.00

MORE salamanders are found in North America than are known from the remainder of the world. Despite this fact there has been no modern comprehensive treatment of this important element in the fauna of America. There are modern books dealing with the snakes, the turtles, and the frogs and toads of the United

States. Now at last we have a thorough summary of information pertaining to American salamanders. The completion of a handbook of lizards (now in preparation) will fill the final gap and place the vast accumulation of knowledge concerning the amphibians and reptiles of the United States at the disposal of all.

There has been marked improvement in the format and scope of handbooks during the last decade, but for satisfactory treatment of its subject none exceeds this work on the salamanders. Its modest title belies the fact that its 555 pages contain the only summarized information available for 126 species and subspecies found within the borders of the United States, Canada, and Baja California. Not only are the adults and larvae described, with keys for their identification, but notes on habitats, sexual differences, and breeding are included. Furthermore, 144 figures depict every species. Equally useful are the maps which delimit the known range of each.

An introduction includes summaries of relationships and general habits. It tells the reader where and how to look for salamanders, the way to preserve them, and how to use keys. Finally, the bibliography provides the most complete list of references yet assembled for any handbook. These are among the outstanding features which make the book a model for works of the sort.

In case the above remarks have left any doubt, the reviewer's enthusiasm for this book is exceeded only by his admiration for Doctor Bishop's meticulous and critical presentation of well organized information.

C. M. B.

A TREASURY OF SCIENCE

----- edited by Harlow Shapley, Samuel
Rapport, and Helen Wright

Harper and Brothers, \$3.95

HERE is a most valuable book—fascinating to read and excellent as a work of reference,—which traces the important steps in the history of science from Galileo's days to the present time. And the thrilling pictures are presented in the very words of the most lucid interpreters of science.

Dr. Harlow Shapley is not only an editor of the volume but he has written a lively introduction entitled "On Sharing in the Conquests of Science." In Part Two, "Science and the Scientist," we find gems from Sir J. Arthur Thomson and Patrick Geddes, Thomas H. Huxley, Albert Einstein, Sir Arthur Eddington, and others. In Part Three, "The Physical World," we have the writing of Copernicus, Galileo, Forest Ray Moulton, Sir James Jeans, and Sir Arthur Eddington about the Heavens. Among those who have written about the Earth we have Hugh Miller, Sir Archibald Geikie, and Paul B. Sears. Among the authors on Matter, Energy, and Physical Law are Sir Isaac Newton, Benjamin Franklin, Paul R. Heyl, and Waldemar Kaempfert. In Part Four, "The World of Life," we find W. J. V. Osterhout, J. B. S. Haldane, David Starr

Jordan, Vernon Lyman Kellogg, William Beebe, Charles Darwin, and Sir Arthur Keith. In Part Five, "The World of Man," we find Charles Darwin, Earnest A. Hooton, Vilhjalmur Stefansson, Edward Jenner, Victor Heiser, James Harvey Robinson, A. A. Brill, and George W. Gray.

As is evident, even this partial list includes some of the greatest scientists of all time and also some of the best interpreters of scientific progress that the world has produced. The story of Gravitation by Newton, of Evolution by Thomas H. Huxley, of the theory of Relativity by Paul R. Heyl, these and many others are briefly but superbly told. Encyclopedic in its scope, it is by far the best book of the kind that this reviewer has seen. It is truly a treasury of science.

CLYDE FISHER.

ERUPTIVE ROCKS: Their Genesis, Composition and Classification, with a Chapter on Meteorites ----- by S. James Shand

New York: John Wiley and Sons, Inc., \$5.00

London: Thomas Murby and Co.

THIS, the second edition of Professor Shand's highly technical treatise on the igneous rocks, has been entirely rewritten and brought up to date with the addition of much new material. It is not a book for the amateur, nor for the beginning student of geology, being designed rather for the graduate student and his professor since it presupposes a broad general knowledge of mineralogy and petrology.

Those who are equipped to read Professor Shand's book will find here a wealth of material and interpretation which will prove of extreme value and stimulation. This is especially true of the introductory chapters, comprising about the first third of the work. These discuss the magmas, their constituents, pressure and temperatures, relations to their walls, together with the order of crystallization, compatible and incompatible phases, and eruptive complexes. Each of these subjects is material for an entire book in itself, yet so concisely and skillfully does Professor Shand write that he succeeds in giving an adequate treatment of each. He still finds space to present theories and interpretations which are certain to provoke considerable discussion in geological circles.

The latter portion of the work is largely devoted to the presentation of Professor Shand's classification of the igneous rocks based, primarily, upon the amount of silica present, and secondarily, upon their alumina content. A rather elaborate, though relatively simple, system of symbols permitting a rapid petrographic description is also proposed. The last chapter contains a discussion of the rock types found in meteorites. These are different from any found in the crustal rocks of the earth but have "just the sort of composition that petrology, geophysics and astronomy combine to indicate as likely to be found in the interior of the earth."

H. E. VOKES.

LETTERS

SIRS:

Your program on October 28, when La Meri gave her distinguished dance program, was a fascinating experience for your entire audience.

It is my personal belief that La Meri, whom I have never had the pleasure of meeting, is the outstanding dancer of this period and that her approach to the subject is of a sufficiently scientific nature to be of interest to every member of your admirable museum. . . .

On the way out I heard nothing but enthusiastic praise of the performance, and I am sure many of us will want to bring our friends if it is repeated.

ETHEL TRAPHAGEN,
Director.

The Traphagen School of Fashion,
New York, N. Y.

SIRS:

Please convey our thanks and appreciation to whoever is responsible for sending us a gift subscription to *NATURAL HISTORY*. The beauty of your magazine and its unusually interesting and informative contents are certain to enrich the lives of the many service men and women who will have the happy discovery of finding *NATURAL HISTORY* in our reading room.

Again many thanks.

ROSSITER D. OLMSTEAD,
Assistant Director.

United Service Organizations, Inc.,
New Brunswick, N. J.

The subscription referred to above was made possible through the generosity of a Member of the Museum who thus enabled service men and women to read a magazine that is not generally available to them in most localities.—ED.

ON YOUR RADIO

Program of the American Museum of
Natural History for Winter, 1944.

WEDNESDAYS over WNYC
from 3:30 to 3:45 P. M.

Science for the Seven Million

This program is now under the sponsorship of *NATURAL HISTORY* Magazine.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at \$1.00 each, with full credit to the photographer. Return postage must be included.

"WAR-TESTED" EQUIPMENT

Once again our equipment is being war-tested and we are 100% on Government work. We can, however, supply certain items, so write your needs. After victory our 51 years of outfitting experience will be wholly at your service.
Write Department NH-1

David T. Abercrombie Co.
311 Broadway New York City



ONE of the many costume dances performed in the American Museum's series for the interpretation of native folklore around the world: the well-known artist, La Meri, performing a Wajong Wong dance of Java

NATIVE DANCES BY *La Meri*

A NEW feature of the American Museum's educational program this season is a series of presentations of characteristic dances throughout the world. Persons planning to visit the Museum may well increase the pleasure of their visit by having it coincide with one of these free programs.

The meaning of the dances and their relation to native cultures will be explained at each performance by La Meri, whose artistry and repertoire have won her an outstanding place among students of native dance. Her studies have resulted in several books. Her latest work, "The Gesture Language of the Hindu Dance," was published by Columbia University and contains a foreword by Dr. Ananda Coomaraswami of the Museum of Fine Arts of Boston.

The American Museum's extensive ethnographical collections from many parts of the world afford the opportunity to correlate the dance programs with collateral phases of native life. The earlier

programs were held in appropriate exhibition halls of the Museum, but the number of persons wishing to attend has made it necessary to schedule future programs in the main auditorium.

For January and February the following programs are announced, each to occur between 3:00 and 4:00 in the afternoon:

Thursday, January 6—*Dances of India*

Thursday, January 20—*Dances of the Orient*

Monday, February 3—*Dances of Spain and Latin America*

Earlier presentations in the Museum's Department of Education program, "Around the World with Dance and Song," have included dance interpretations of Africa by Asadata Dafora (author and director of the famous African dance dramas *Kykunkor* and *Zunguru*), and others by the Chippewa Indian, Little Moose, and by Charlotte Ching, a native of Hawaii.

Eagles I have

IT was late afternoon, a cold wet afternoon near the end of April, when I drove into the settler's brush-bordered yard in the cutover pine country along the Little Muskegon and knocked at the door of his shabby, unpainted house.

"They told me down at the Croton Dam that you know the location of an eagle's nest in a big pine somewhere in this neighborhood," I said to him when he answered my knock. "How about it?"

He nodded. "Guess I do," he agreed. There was just a hint of self-importance in his voice.

"Well," I explained, "I want to make some pictures of the young eagles. Can I hire you to show me the nest?"

"Pictures?" he demanded. "How you gonna get any pictures? That nest is way up in the top of the pine."

"I'll have to climb the tree," I admitted.

His eyes widened. "You can't do that," he exclaimed in astonishment. "Them old eagles will tear your head clean off your shoulders! Why, I was drivin' a team past that nest last summer and they come after me right down on the wagon. I whipped up the horses and got away but it was a close shave!"

I saw my chance to drive a bargain and took it.

"Tell you what I'll do," I offered. "You take me to the nest. If I climb it and get the pictures I'll give you a set. If I don't I'll pay you ten dollars for your bother. What do you say?"

"I'll take you," he agreed, "but I'm telling you now you can't climb that pine tree and come down alive!"

He meant every word of his warning, too. That is the sort of undeserved reputation Old Baldy has among human neighbors who are not acquainted with his craven ways.

An hour after I knocked at the settler's door I was making one of

The bird which symbolizes our country demands courage and perseverance in anyone who would learn his ways

the most difficult climbs I had undertaken in years of bird photography and banding. The eagles had chosen their aerie tree wisely. The pine was an ancient Norway, a holdover from the days before the logging crews came down the valley of the Little Muskegon. It grew on the slope of a deep, bowl-like depression in the hills, its great trunk rising clean and without branches to a feathery green crown. Where the first branches broke away far above the ground the eagle nest was perched, a flat, bulky platform of dead sticks. The hollow ring of the tree under my climbing spurs as I started aloft told me why the lumbermen had passed it up, leaving it there by itself, a solitary landmark towering high above the lesser second growth.

The rough bark was wet and slippery with rain, making the climb both hard and dangerous. I inched my way up a step at a time, driving the spurs deep, leaning my weight on the loop of my safety rope. My guide hunched down on his heels a hundred yards away, at the rim of the bowl and almost level with the nest, and waited for winged vengeance to come streaking out of the cloudy sky and sweep me from my slender foothold. I think he was even a little disappointed when it failed to happen.

When we had come in to the nest through the dripping, leafless April woods, the male eagle had sprung into the air from his lookout perch on a near-by dead stub, wheeling and screaming his resentment at our intrusion. Almost instantly the hen bird left the nest to follow him up, adding her wild and angry cries to his. The two of them hung there above the pine, turning in broad circles, shrilling their rage far across

the river valley, while I strapped on my climbers, adjusted my ropes, and began the climb.

But when I left the ground the two eagles veered higher into the sky. As I climbed they circled up and up, their savage outcry coming down to the rain-drenched earth softened by distance. And when I rested my feet at last on the two big branches that held the aerie, 80 feet above the ground, and stood there clinging to the tree, breathless from the climb, wet with sweat and rain, the eagles were turning restlessly a full thousand feet overhead. Their screaming had fallen away to an occasional troubled, querulous cry.

From that vantage point I could look far away, over the woods and across the river, and see cleared farmlands in the distance. From those fields the eagles had gathered the carpet for their nest, a thick pad of dry cornstalks arranged to form a shallow, saucer-like bowl. One gray, down-clad eaglet huddled there, hissing and snapping his beak at me, croaking his fear and dislike in the guttural tones of young eagledom.

To spare him needless exposure to the cold rain I finished my pictures as quickly as I could and climbed down and left him. Because I had with me that afternoon no leg bands of the United States Biological Survey of a size to fit a young eagle, I went back with a companion two days later and made the climb again, shaping a numbered aluminum ankle to his leg.

Months afterward, in February, I had word from that band. It came in the form of a brief, official card from Washington and the news was not good. It told me that the soft-plumaged, helpless young sky prince whose rage had died away so quickly

known

By BEN EAST

OLD BALDY, king of birds and emblem of America. This eagle was for many years a captive at Omena, Michigan





▲ WHERE the bird bander must become a lumberjack; the author reaching an inaccessible nest in a towering old pine tree



▲ BIRD ELEVATOR. A young eagle is lowered in the basket by a helper for banding on the ground

once I covered his head with a battered old felt hat, and who had submitted to handling and banding with no further show of hostility, had come to an untimely end on his first winter flight. An immature bald eagle wearing a band of that number, the card said, had been killed near Reelfoot Lake, Tennessee.

We were far from happy about it, recalling the nest in the old pine where he had been fledged, the view he had had of the river, the free skyways he was born to travel, the brief time we had held him captive in our hands. But at least we had learned where some of our young bald eagles traveled when they left their nesting place in northern Michigan at the end of summer. We had added one infinitesimal bit to the great mass of knowledge concerning bird ways and bird migrations. The climb up the ancient pine had been worth-while.

Needless to say, I paid my guide of that April afternoon with pictures. On the way back to his house, he kept silent on the subject of eagle attacks. I still do not know whether his respect for me had gone up or his admiration for the emblem of America had declined.

The behavior of the two birds at

the nest that day was typical. In the last 20 years as a camera hunter and bird bander, I have paid scores of visits to the aeries of bald eagles. When Walter Hastings, staff photographer of the Michigan Conservation Department, and I began our eagle banding operations in this state back in the spring of 1927 only four American eagles had been banded in the entire country, if I remember the old statistics aright. We banded three more that first spring, all young birds in the nests. The total I have banded since is far from imposing, incidentally. It is not easy to set numerical records in eagle banding. The birds are none too common in this part of the country, and each nest visited represents a stiff and often dangerous climb.

In all the times I have called on Old Baldy in his unfailingly inaccessible sky castle I have never been molested, attacked, or seriously threatened with attack. Always by the time I have reached the nest its rightful owners are far away, wheeling through the distant sky, voicing whatever hate they feel for me at a safe distance, refusing to come back within either gun or camera range until they are sure I have left the neighborhood. Only once did I see an eagle break

this rule of behavior. That was the hen bird at the first nest I ever found. The second or third time I climbed to it she left off her distant sky wheeling, suddenly and without warning, and came stooping down at me in a soundless rush on widespread wings, making no outcry at all.

My perch was an uncertain one, in the high branches of a big oak 50 feet from the ground. She could have swept me headlong from the tree with one blow of her great wings. But she did not try. Instead she leveled off in her hurtling plunge a few yards beyond the oak top and then came soaring through the branches just above my head. She did not scream or strike at me with beak or talons. But she passed so close I felt the wind of her silent flight, heard the soft rustle of air along the great wing surfaces, could have reached up a hand and touched the mailed, yellow feet. Just past the tree she turned, circled, and flew over me again. She repeated the maneuver three times in all, not threatening me in any way, making no outcry. I have always suspected she came down to look me over, to learn whether I was really doing harm to her nest and its three helpless fledglings. I have always been glad she at-

tempted no more than a reconnaissance flight. She is the only eagle of my acquaintance who dared even that much.

The sorry truth is, Old Baldy is a coward. I wish it were otherwise. My admiration and affection for him are without limit. In many ways he is the living symbol of all we believe in, here in America. He is the essence of a free creature, born to the lonely wilderness, to the solitude of wild places. As long as he lives he knows the open vault of sky above his head, the free wind beneath his wings, the checkerboard of fields and woods and earth-bound things far below. He dips at dawn into the mists of lakes that never know a paddle blade. He watches the sunset from crag or stub beside which no human foot has left a trail. His voice is the voice of the untamed, and his fierce yellow eyes under their beetling white brows bespeak a heart that prefers death to a cage.

But still the unhappy fact remains, Old Baldy lacks courage where defense of his nest is concerned. If he could match the flaming bravery of the little rubythroat, if he were as dar-



▲ IT'S DIFFICULT WORK, and not too safe



▲ ON THE GROUND the aluminum bracelet bearing a number is fitted around the leg. Wherever this bird is found, the record of its flight will be filed with the United States Fish and Wildlife Service. Information on the migrations of birds is thus continually being gathered

ing in the face of great odds as the kingbird, no living man would climb with impunity to his tree-borne castle. None would probe casually the guarded secrets of the bulky aerie where his young are cradled.

As for the eaglets themselves they tame almost as readily as fledgling robins. When a human intruder first appears above the rim of their nest, their distaste and apprehension is fierce and vocal. They back off to the farthest edge of the bulky platform, if they are old enough to stand, croaking, hissing, and warning the unwanted visitor away with a great show of angry beak-snapping. But the anger soon cools. Of all the young eagles I have handled, filmed, and banded I have yet to have one strike at me with talons or beak.

The technique for fitting a band to the leg of one of these sky princes is a simple one. You reach quietly across the nest, making no sudden motions to alarm the youngster needlessly, and drop a hat gently over his head. With the light of day and the sight of the enemy thus shut out, the croaking and beak-snapping die away. It is an easy matter to lift the great yellow foot and hold it while the band is shaped and fitted and locked in place. After



that brief contact the eaglet seems to lose his resentment and gain confidence in the visitor's friendly intentions. He rarely shows much further concern.

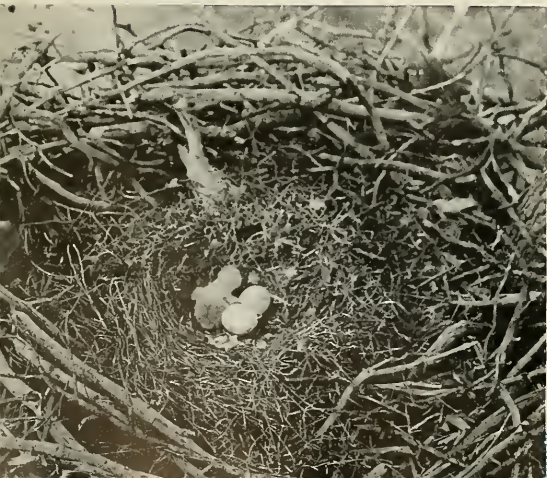
The strangest eagles I have ever known were a pair in northern Michigan that forsook the normal ways of their kind one spring and built their aerie on the ground. It was not necessary, for they were in forested country, and plenty of satisfactory nesting trees were available. But for some reason they did not choose a tree.

They selected an open location on the dry cutover pine plains. On a grassy hummock only a foot or two high they built up a poor platform of dead sticks and lined it sparingly with grass and weeds. Human visitors found the nest when the two eaglets were only a few days old, and almost immediately the young birds were driven out by thoughtless intruders. The smaller perished in a chill spring rain. The other survived and despite the unnatural conditions he was fed and cared for by the parents throughout the summer. He grew to be a lusty youngster, taking wing finally without mishap exactly like any eaglet

▲ IF SUDDEN MOVEMENTS are avoided, the sky prince usually loses his resentment after brief contact and gains confidence in the stranger's friendly intentions

► THE AUTHOR looks down on the nest where his first banding was done in 1927

▼ AN EAGLET HATCHES



reared normally in the high branches of a tree.

Years after that, along the treeless, wind-swept beaches of the Aleutian islands, I saw many bald eagles nesting in that same fashion on the ground. Old Baldy does not even have dead sticks with which to make his aerie in the Aleutians. He must content himself with weeds and grass and dry kelp, and the nest is humble indeed for his kind. Usually he chooses a site on a grass-grown, rocky hummock not far from the beach, where his hunting grounds are conveniently near at hand.

For all his strange surroundings in those far-off islands of the north Pacific, if you invade his castle he behaves exactly like the eagles I have known along the sand dunes of Lake Michigan. While you are still at a distance he rises from his lookout perch on the sea cliffs, wheeling and screaming through the sky to warn you away. But if you climb the aerie hummock for a close look he and his mate will circle together far overhead, challenging you only from a safe height, perhaps finally dropping down to perch in resignation on a distant promontory. And the fledglings in the nest will greet you in the fashion of young eagles everywhere, croaking and hissing to fend you off but quickly growing tractable and almost friendly if you insist on close acquaintance.

▼ IN A TREETOP near a new nest the author built a tiny burlap observation tent. Here he and his fourteen-year-old son passed the night so that the birds would not be aware of their presence



FROM THEIR NEAR-BY PERCH the observers were able to study the family life of the nest. The hen eagle, immature and not yet in full plumage, is alighting and inspecting her eggs



The eagle family I came to know best of all I did not band. I watched them instead at a distance, from the shelter of a tiny tent of faded green burlap perched above a swaying platform in the topmost branches of a tree 25 yards from their nest.

The aerie was built in the top of a black gum, no more than 30 or 40 feet above the ground. It was newly placed and lacked the great bulk and solid-

ness of an old and long established nest. When I was guided to the place in mid-May, the two young eagles were big enough to stand upright on the rim of the nest. They watched us with no show of fear while we moved about on the ground below.

Less than a hundred feet from the gum tree stood an oak of equal height whose upper branches promised secure anchorage for a small aerial blind.





not know we were there when morning came.

We slept only fitfully, curled up with our cameras and other gear on the tiny platform, and the bird chorus of dawn brought us fully awake. We were in time to see the young eagles bestir themselves, stretch, back deliberately to the rim of the nest one at a time, and void forcefully over the side, in the characteristic gesture by which these birds, almost from birth, keep the interior of their nest clean and sanitary.

At sunrise they got the day's first feeding. The male eagle came sailing in through the treetop carrying a freshly killed fish. They rushed across the nest to meet him, snatching the fish from his talons before he relinquished his hold, falling upon it savagely and greedily. The old bird wasted little time with them. He stood at the side of the aerie for a minute or two, watching them at their gluttonous breakfast. Then he opened his great wings and glided silently off, perhaps to a distant lake or river to do some fishing on his own account.

When the young birds finished their meal, they settled down on the pad of dry grass that lined the nest and

▲ A GRACEFUL TAKE-OFF

I decided to try this time for intimate pictures of eagle family life, made in secrecy when neither the fledglings nor their parents suspected my presence.

I climbed the oak and spiked short lengths of 2x4 in place for girders. With the help of a small ground crew I hoisted up a solid, prefabricated platform four feet square and made it fast, almost exactly on a level with the nest. Over the platform I erected the burlap tent that had served me for years as a blind in making bird pictures.

When the work was finished, we went away and left the eagles undisturbed for a few days to afford them a chance to grow accustomed to the blind in the neighboring treetop. Then one night at midnight we went back, my fourteen-year-old son and I. We hauled our heavy cameras up to the platform, crept inside the cramped quarters of the tent, and settled down to get what little rest we could until daybreak.

By entering the blind under the cover of darkness and as quietly as we could, we made sure the eagles would



rested, lazy and content, for an hour or more. Hunger seemed to stir in them and they arose and stood for a long time, staring off across the top of the forest, waiting silently and patiently for another fish. It came at last, a heavy-bodied sucker still gleaming wet from the river, in the talons of the hen eagle. Again they tore at it ravenously, and again the old bird stayed at the nest only a short time.

Apparently this was the established routine of feeding once the eaglets reached a size where they required no help with the fish. It was repeated throughout the day without variation at fairly regular intervals, as Old Baldy and his consort came back time after time with fish to replenish the empty pantry shelf. From what we saw from our blind that day and on other days, we came to understand that nesting eagles, like most birds



▼ IN DRASTIC DEPARTURE from their usual ways, one pair of eagles was found to have built their nest on the ground in the open pine plains of northern Michigan. Their fledgling, shown here, deserted the nest early in life, but his parents raised him successfully despite the unusual home site



▲ IN THE FAR-OFF ALEUTIANS, where there are no trees, American eagles nest regularly on the ground. This pair faced the camera on Tanaga Island in the summer of 1941

with fledgling young to care for, lead a busy life. Their hunting is never finished. No matter how many fish they may tote home along the unmarked paths of the sky, the youngsters will be waiting their return, hungry and clamorous. There is no rest for them until the eaglets leave the nest and are able to fish for themselves. It does credit to Old Baldy's skill as a hunter that he is able to feed his family and himself.

In midmorning that day we watched the elder of the two eaglets go into his flight training routine. It was the most interesting and ludicrous bird performance I have ever filmed.

He began by walking to the edge of the nest and stretching his wings to full length. Then he started to flap them and at each flap he leaped straight up into the air. He bounded higher and higher, his yellow feet hanging down like the legs of a mid-gut circus performer who has lost his pants, until he was clearing the nest by two or three feet at each jump, lifting himself up by powerful, sweeping strokes of his outstretched wings. We expected to see him lose his precarious balance, caught off guard by the brisk wind that was swaying the nest back and forth through a dizzy arc. Time after time we thought he must surely miss the flat platform on alighting. But each time he came down safely and leaped vigorously up again.

Gradually he tired and his exercises subsided. When after a minute or two he settled down to rest, the smaller eaglet arose, walked to the rim of the aerie, and took his turn. In that fashion do young eaglets train for flight, toughening their muscles, developing their precise sense of aerial balance, long weeks before they are ready to venture from the nest for the first time.

When summer was waning we took our burlap tent down, leaving the bare platform perched in the oak, hoping to use it another year.

Early the next April we went back to start the season's camera record. The aerie was occupied but a strange thing had happened. The hen eagle that spring was not the mature, white-headed bird of the previous summer. Old Baldy had brought home a new wife, a young bride with grey-brown head and tail.

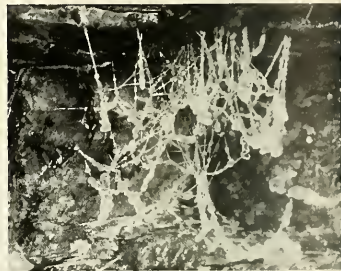
We concluded that death had separated the original pair somewhere on their winter wanderings, because eagles ordinarily mate for life. And before we had more than begun our work from the blind this time other visitors found their way to the aerie, disturbing the birds. Then a forest fire ran through the dry spring woods and we went back one day to find the nest abandoned and the eagles gone. They never came back again to the black gum tree or to that neighborhood.



▼ **SPRAY ICICLES.** One cold morning after a thaw these unusual ice deposits were found at the base of frozen Outlet Falls. A blast of spray-laden air rushing from a cavity at the base of the pillar formed this cluster of peculiar icicles with oval cross section



▲ **A SPIDER WEB** near by under a limestone shelf had also caught spray, forming icy beads along its silken strands



◀ **ICICLES AGAINST THE WINTER SUN** in the Helderbergs

Winter Magic

By VINCENT J. SCHAEFER

All photos by the author

THE coming of winter weather serves in many ways to convert scenic areas throughout the countryside to a state of semiwilderness. Few persons venture to the places that in summer are visited by many. Those who do are rewarded by seeing familiar scenes enhanced by a snowy blanket that softens the contours and supplies an entirely new aspect of unexpected beauty.

One of the most interesting rewards of a winter exploration trip is the finding of unusual forms and structures

of frozen water. Created overnight or after months of slow growth, they arouse conjecture and wonderment in anyone intrigued by the laws and pranks of Nature.

In the eastern part of New York State within less than a dozen miles of more than a quarter of a million people living in the environs of Schenectady and Albany, are the Helderberg Mountains. Rising nearly a thousand feet above the sand plains of ancient glacial Lake Albany, the Helderbergs and near-by Helderhills are

a favorite summer playground for many thousands of city folk. In the wintertime the rocky cliffs, tumbling streams, and cave gulfs are almost solely in the possession of the pileated woodpecker, hibernating bats, and King Winter. Few people, save skiers and occasional naturalists visit the region. Weeks pass without a single person venturing along the Bear Path trails at the base of the limestone cliffs.

Some of the weird formations that can be seen by the winter trampler are illustrated and explained here.

➤ **SNOW PEAKS OF LILLIPUT.** These miniature saw tooth ranges were carved out of drifted snow in a curious manner along the Lower Bear Path. Small rock fragments and twigs had fallen onto the snow from the cliff during the winter period. Then with the coming of warmer weather, water dropping from

the melting snow apron at the top of the escarpment was deflected whenever it hit these small particles, to erode the snow as shown. Each peak was topped with its protecting "cap rock," which remained in place until, warmed by the late winter sun, it melted into the center of the cone or slid down its south side



▼ **ROCKS LAID DOWN** under water 300 or 400 million years ago in the Age of Fishes (Silurian and Devonian Periods) form the Helderberg escarpment. At several places small streams emerging from caves above the cliffs plunge over the precipice. In cold weather many interesting and varied ice formations may be found where the falling water has been frozen in odd shapes. The scene shows an ice cone and pillar at Minelot Falls, with Mohawk Valley Hiking Club members at the base





▲ TO BE OR NOT TO BE: seven-day-old stalagmites, subject to the weather's whim

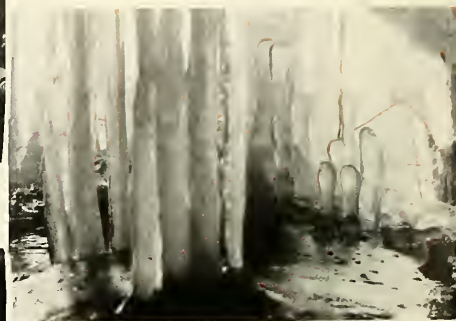


▲ AT THREE WEEKS the "upside down icicles" have grown noticeably, while fingers of ice reach down toward them from the roof



▲ FOUR WEEKS OLD and receiving increased support from above. Note changes in the thickness of stalagmites, resulting from changing weather conditions

▼ AT FIVE WEEKS sturdy columns of ice have formed a sort of fence in front of some of the more delicate members of the stalagmite family



▲ WHEN THE STALAGMITES were 49 days old they had reached the peak of their development and were beginning to melt

The rise and

THAT strange mortal who enjoys crawling through slippery passageways, wading or swimming through almost freezing water, and wriggling under precariously perched rocks in the dark caverns of the limestone country may be referred to as a "spelunker." The name comes from "spe-lunk," meaning cavern, an English word of Greek origin. He sees many strange things in his explorations. One of the most beautiful spectacles encountered in the winter are ice stalagmites and pillars. They occur usually not far from the mouth of a cave where the cold air from the outside meets the humid air from the interior. Huge and magnificent frost crystals often adorn the cavern walls and create a jeweled setting for the ghost-like forms of the nether world.

Single drops of water, falling past the motionless forms of sleeping bats, land on the rocky floor and freeze, slowly building up a stalagmite of ice. When the water drips from many spots on the rocky ceiling, a score or more of these stalagmites may form in the course of several winter months. Some of them exceed eight feet in height. As a stalagmite grows, its diameter varies in response to changes in temperature, the rapidity of seepage, and other factors. Thus a stalag-



▲ THIS LENGTHWISE SECTION of a stalagmite reveals changes in the weather that were recorded during its formation. Similar "banding" is noted in true stalagmites and recalls the changing thickness of tree rings. The white, translucent layers of ice contain myriads of tiny air bubbles which scatter the light; so-called "black ice" is crystal clear and free of bubbles

▲ "ANKLE-DEEP" IN WATER, the family of stalagmites face unavoidable ruin with the approach of spring but continue to display a beautiful series of changes as they decline

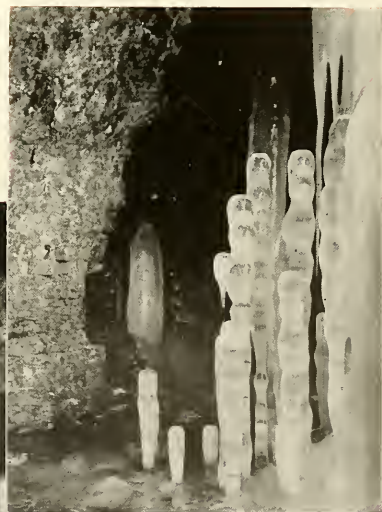
▲ THE "DIMPLE" in the tip of the stalagmite above may have been caused by the dripping of warmer water, just as its growth was originally caused by icy drops

fall of a family of ice stalagmites

mite over six feet tall and several inches in diameter at various levels will sometimes be less than an inch thick near the bottom.

At times stalactites of ice also form and merge with the stalagmites be-

neath to form ice pillars. These and other forms that occur nearer to the walls are the identical counterparts of the stone stalactites and stalagmites seen in the inner reaches of caves.



▲ THE MOST INTERESTING ice stalagmites in the Helderbergs are found in Tory Cave, a shallow, high-ceilinged cavern in the soft face of the limestone cliff along the Upper Bear Path

◀ THE TALLEST ice stalagmite in this photograph is eight feet high

Along the upper reaches of a stream named Bozen Kill that tumbles out of the Helderhills, *foam volcanoes* are sometimes found at the foot of waterfalls. These formations receive their name from the unique manner in which they form.

A number of chance circumstances seem to be necessary. A slight thaw must occur on the headwaters of the ice-locked stream. The water must contain organic, film-forming matter such as one finds on pasture land. Tumbling over the rocks, the water traps air and forms bubbles which pile into foam. At the base of a waterfall the foam is forced out of occasional air holes and freezes before the bubbles break. (The weather must be cold and still if big ones are to form.) As a general rule the foam freezes in a circular rim around the air hole. Succeeding masses of foam emerge, freeze, and build a symmetrical cylinder of frozen foam.

After growing about six inches, the cylinder begins to act like a bubble pipe. The foam is either forced upward gradually by the creation of additional foam below or, as occasionally hap-

pens, it is spewed and puffed out of the cylinder—hence the name “foam volcanoes.”

Some of the foam drifts free into the air and slowly floats away, although most of it gathers and freezes on the rim of the cone or cylinder. Under favorable conditions the writer has found these amazing structures twelve feet high. Though they look massive and heavy, they are as light as gossamer, and a searching sunbeam soon removes them from the wintry scene.

Once the writer happened along the “Bozie” at the right time to make a discovery. It was late in the afternoon, and the air was below freezing after a thaw. We found that one could, like Vulcan himself, induce the stream to form volcanoes, by cutting small holes in the ice at the base of a fall.

▼ **FOAM VOLCANOES.** Sometimes the froth that freezes to form these strange towers is spewed and puffed out of the top—hence the name. They are formed of foam created at the foot of an ice-covered waterfall and forced out through a small hole to freeze



▲ **FOAM VOLCANOES** look massive and heavy, but are light as gossamer. A searching sunbeam soon removes them from the winter landscape



RODENT MINERS

By JOHN ERIC HILL
Drawing by
G. FREDERICK MASON

IN western and southern United States and parts of Canada and Central America, millions of pocket gophers, or as they are called in the South "salamanders," spend their lives in the underground runways they dig. They come out only rarely to cut plants and to push out the dirt excavated in their tunnel-making in their constant search for roots and bulbs, their chief foods. Ninety per cent or more of their lives are spent in the darkness of their subways.

They vary in size in the different places, from the length of a fountain pen to more than a foot, not counting the rather short, naked tail. They have the general shape of a streamlined bus, the body tapering slightly rearward from the large head. Their burrows need be only about the diameter of their bodies, for their legs are short and they run crouched.

Pocket gophers have little need to see in the darkness of their burrows. But their little shoe-button eyes are set on top of the head where they are most useful when the animal pokes its head above ground. From all I have been able to discover they are quite

nearsighted, but they see movement fairly well if not too far away. Their hearing is not very keen, but their sense of smell is well-developed, particularly for finding food, rather than detecting the presence of enemies. And though the pocket gopher has a powerful set of incisor teeth and a fighting disposition, his chief protection is his habit of creating his own world underground.

No animal works harder for a living. After a rainy spell tunnels are often dug at almost unbelievable speed. In the sandy soil of a Florida orange grove I followed a line of mounds that ran almost straight for over 200 yards—about 1000 times the length of the gopher's body. These were the work of a single animal and had been thrown up in about 48 hours. Even in the heavy gumbo of the Middle West, gophers often dig long distances overnight—the equivalent of a man digging a foot-deep trench half a mile by hand.

The animal braces himself on his spread hind feet and feverishly scratches like a dog. When the dirt accumulates under his belly, he kicks it back with his hind feet. Then the gopher ducks his head under one hind leg and turns a half somersault in the narrow tunnel. Now facing the pile of

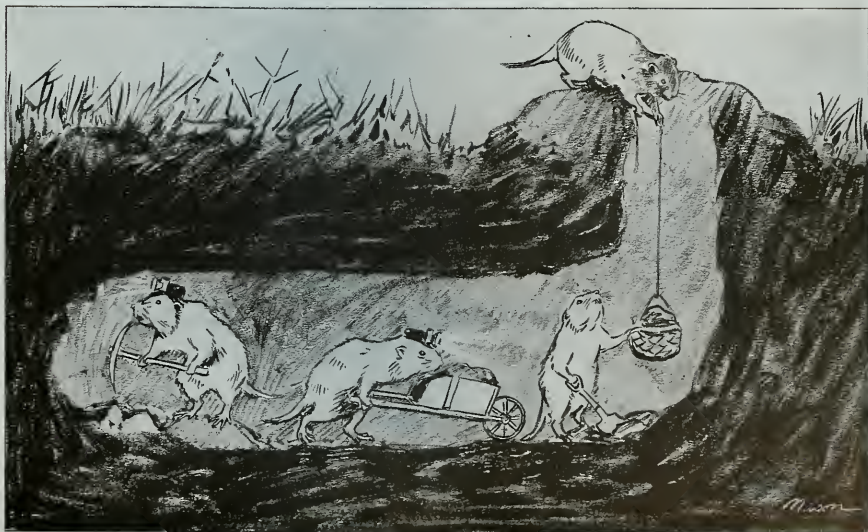
dirt, he cups his big front feet together under his chin. The outer fingers and wrist are fringed with bristle-like hairs, and he pushes the dirt out as if he had turned into an animated bulldozer. In spite of what people often say, the cheek pouches from which he gets the name "pocket gopher" are not used to carry dirt out of the burrow, but only to carry food.

In hard-baked clay, even big sharp claws can make little progress. Pocket gophers living in such regions have specially constructed teeth which project farther forward and are used as picks. The claws are correspondingly shorter than in the sand-burrowing gophers. The pocket gopher's mouth is arranged so that he can actually close his lips *behind* the incisor teeth and thus keep dirt from getting into his mouth while digging.

In the pebbly hills of our southwestern desert country a few gophers manage to live. Here neither teeth nor claws can be very helpful. Some I found near Carlsbad Caverns, New Mexico, drove their tunnels from one lechuguilla plant to another, only a few inches below the surface. They were little gophers, as if dwarfed by their hard life, and very different from the big ones of the rich river valley near by.

One may well ask what the millions of pocket gophers in North America could do if they developed a co-

operative plan. One of the animals alone has been known to dig a tunnel over 200 yards long in 48 hours



The Aardvark and the Armistice



Photograph by Capt. R. O. Croce-Read

NOTE the "earth-pig's" large hind feet and thick, heavy tail. This aardvark measured five feet two inches from tip to tip, stood 24 inches at the shoulder, and weighed 120 pounds. It severely clawed its captor

By

A. LOVERIDGE

"*BHANA*," said Salimu with a grin, "the askari [native soldiers] say there's a *muhanga* in their camp."

"What's that?" I replied, "I don't know a *muhanga*."

"Of course you do," he answered somewhat impatiently and launched forth on a description which I recognized as that of an African ant bear or aardvark—to give it the name bestowed in South Africa by the early Dutch colonists. Aardvark, signifying "earth pig," is the more appropriate, for there is nothing bearlike about the creature, while its snout, long ears, and skin are decidedly piglike. In the South African aardvark the skin is comparatively bare, having only a sprinkling of coarse hairs. It is the more abundant hair of the East African form (*Orycteropus afer aethiopicus*) that serves to distinguish it from its southern relative.

Now, thanks to the Armistice, I was to make the acquaintance of this strange creature seen by so few Europeans. It was December 1918, and I had been ordered to Tabora in central Tanganyika Territory in connection with the demobilization of thousands of soldiers already assembling there. During the previous night the aardvark had wandered through the lines of the King's African Rifles and found an old burrow. He enlarged it somewhat, and retired for the day, leaving a telltale trail of footprints leading to the entrance.

There were plenty of men with nothing to do while waiting to be paid off, so I suggested to the Colonel that a few of them might get exercise and employment in excavating the aardvark. The Colonel was not very cooperative until I reminded him that

Firsthand observations shed light on a curious animal, in spite of the fact that it pulled its pursuers part way into the ground after it

the burrow, being in the center of the camp, could well result in a broken leg if some soldier should stumble into it in the dark. I was allotted eight men, whom I set to work at 7 A.M. Except for an hour's rest at noon, they worked in relays right through till 4 P.M., when I was free to join them.

During my absence they had excavated a furrow in the sandy soil for a length of about twenty feet. It varied in depth from six to ten feet. They reported having twice caught sight of the ant bear's tail. Urged on, they redoubled their efforts. As soon as one pair were exhausted another took their place, until presently I caught sight of what I took to be a foot throwing back the earth. Actually, it was the tail, which I later learned was used as an aid to the feet. This tail is extraordinarily thick and heavy, and is said to be used like that of the kangaroo. In the case of the aardvark the tail is used to support its owner when clawing out termite hills.

After digging furiously for another half-hour, one of the lads was able to seize the tiring aardvark's tail. Two other natives held on to the legs of the first fellow. Nevertheless he was slowly but surely drawn into the burrow up to his waist, as muffled cries proceeded from him. Eventually he relinquished his hold and was pulled out, after being fairly smothered in the loose sandy soil.

Digging was resumed instantly, and when the animal was again overtaken the same adventurous youth attached

a rope to one of its hind legs. Half-a-dozen men held on to this rope while a second line was fastened to the other leg. By means of these ropes we hauled the aardvark from its burrow like a refractory cork from a bottle. With startling suddenness, one of the ropes snapped as the creature came charging in the direction of those hanging on to the remaining rope. Some of them let go and fled precipitately, adding to the confusion of the small, dispersed crowd that had gathered about the entrance. A few brave souls, however, held on grimly and were dragged along as the aardvark plunged about like a tethered bull, till it came to an abrupt standstill.

I had brought with me only a twelve-gauge shotgun, being unwilling to discharge my rifle in a crowded camp and also anticipating a better specimen with undamaged skin. Now, from a distance of only 20 feet, I fired with No. 5 shot. Though these hit the aardvark full in the neck, it only gave a sudden plunge and otherwise took no notice. Before I could stop him, one of the natives ran up and brought down the butt end of his mattock upon its head with all the strength he could muster. The only effect was to cause the animal to rear up on its hind legs, snap the second rope as if it had been string, and start off across country in its peculiar, though quite fast, gallop.

I felt heartily ashamed of having so miscalculated things as not to have killed the beast outright. Had it been unwounded, I would willingly have

let it enjoy its well-earned freedom. But supposing that it might have received injuries which would eventually cause its death, I saw nothing to do but to finish the matter as quickly as possible.

The decision was already out of my hands, however, for about 50 of the native soldiery who had gathered at the sound of the shot were already in full cry after the aardvark, and I joined the pursuit. The animal went to earth in a burrow on the railway embankment, and when we arrived all that was to be seen were jets of earth following each other in quick succession. Eager hands were soon at work digging. Then the aardvark, having come upon some obstacle to further progress, changed its mind and left the burrow with great celerity. A moment before, natives had been crowding round to get a glimpse. Immediately all this was changed, and they were shouting and falling over one another in their eagerness to retire to a safer distance.

As the aardvark brushed past him, a big Kavirondo brought his club down with terrific force upon its head. The handle of the club snapped, but the animal continued on, ignoring the blow, till it found another burrow some little distance away. Instantly the first man to arrive grabbed it by

the tail and hung on while others again attempted to fasten ropes to the hind legs, which were busily engaged once more in throwing out sand in powerful jets. Boy after boy fell back to spit sand from his mouth and clear it from his eyes and wool, but each place was promptly taken by another volunteer. Excited by the chase, they vied with one another, so there was no lack of willing helpers. At this juncture a fellow officer ran up with a rifle and, with a single shot, ended the poor beast's life.

It was a male measuring five feet and eight inches from snout to end of tail. Nearly two feet of this was stumpy tail. The skin was tremendously thick, which explained why the charge of shot had apparently never penetrated the neck. After examining the skull's solidity I could appreciate the futility of mattock and club. The feet and short thick limbs were admirably adapted for digging, there being four toes on the front feet, five on the hind, all armed with large and powerful claws with which the animal could tear down the tough hillocks of termites.

Its diet should commend the *mu-hanga*, as it is called in Swahili, to the mercy of everyone who suffers from the depredations of the pestilential termites. Having torn a hole in the side

of one of their hills, the aardvark inserts its long, sticky tongue, which is soon covered by enraged termites; the tongue returns to the mouth, and the termites are never seen again. One can only guess the enormous number of termites which are consumed daily to nourish so bulky an animal. The weight of the one described appeared to be well over a hundred pounds. The supply of sticky mucus is produced in glands beneath and beside the tongue.

Though the big burrows made by an aardvark as it moves about the country in search of termites are to be found throughout the savanna regions of equatorial Africa, the animal itself is rarely seen on account of its strictly nocturnal habits. Only once have I seen an ant bear on the prowl, and that was in bright moonlight at 1.10 A.M. near Mbala in the Kilosa district. The aardvark was 50 yards away, so I did not get a very good view, but there was no mistaking such an extraordinary creature as it lumbered past the tree in which I was sitting awaiting the coming of a leopard.

Three years after the Tabora incident Salimu again reported the presence of an aardvark. This time the creature had gone to ground in my vegetable garden a few miles from Kilosa. With our former experience in mind, we decided a snare would achieve our purpose without wrecking the entire garden. So, bending a young tree over the entrance, we set a powerful snare at the mouth of the burrow. Next morning, on visiting the trap before sunrise, I found it sprung; evidently the aardvark had "put his foot in it," but only a piece of rope dangled from the now upright tree. The rope was a stout one, so we examined it in some astonishment to find the end frayed.

Once again we set the snare, only to have a repetition of the former experience. Our suspicions were confirmed: the aardvark had chewed through the rope! This was of particular interest for, despite the few simple teeth in both upper and lower jaws, the creature had long been classed with the Edentata, or "toothless" animals. Zoologically the aardvark had remained something of an enigma for many years until its numerous peculiarities resulted in the creation of a special order for it, the Tubulidentata ("Tubule-Toothed").

Long may it remain there in peace, now that it is protected by international fiat throughout Africa.

THE AARDVARK has powerful claws and a long, sticky tongue. The tongue darts into a termite hill and returns to the mouth covered with termites, which are never seen again

New York Zoological Society photograph



DESERT DWELLERS



▲ THE WORLD OF THE DESERT is more than a land of purple mesas, blue bajadas, and flaming canyons; it is a marvelous laboratory where Nature constantly experiments with drouth-defying plants and animals. The results, told in the lives of its wild citizens, makes it probably the most unique out-of-door studio within our borders. This typical expanse of Sonoran Desert, is seen on the Hassayampa Plain, in south-central Arizona

◀ CACTUS WREN. To search across the dazzling cactus expanses for a dwarfed, retiring cousin of Jenny Wren would be futile. Surprisingly, the desert's model is double size, sprightly tailored, with an even greater reputation as a chatterer and scold. The Cactus Wren cleverly turns to her own use the treacherous arms of the "jumping" cholla or the forbidding, bayoneted branches of the yucca, constructing her odd funnel-shaped nest in them

By JOHN L. BLACKFORD

Photographs by the author

IN a land oppressed by heat and drouth, where plant life is commonly hostile and where each must so often become a foe to the other, the fascinating furred, feathered, and scaled dwellers of our Southwestern deserts lead lives of absorbing interest. To defeat the torrid sun, they, like the strange, weird cacti, yucca, ocotillo, and agaves that surround them, have devised ways to resist or evade or escape its rays.

Many, especially among the mammals, favor night life lit by the coppery desert moon, when the fine, wind-sifted sand is the most faithful recorder of their ceaseless activities. Others are so marvelously adjusted to the moisture content of their solid food that they never indulge in a drink from birth to death. Just as numberless leafless plants about them conserve water, so do the grasshopper mice, kangaroo rats, and their rodent friends survive without perspiring. For many the water ration is said to be secured from solid foods by the chemical process known as hydrolysis



▲ DESERT DIAMOND RATTLESNAKE. Far more than the Gila Monster, the Desert Rattlesnake deserves a sinister name. When the flinty desert "pavement" becomes overhot for tender belly scales, he coils in the shade of a creosote bush, and does a large share of his hunting after sunset. Thus, habit as well as physical form enables residents here to survive in this strange land of the sun

▼ KIT FOX. The splendid little "desert swift," or Kit Fox, is easily the handsomest representative of the larger mammals in our arid Southwest. The huge "receivers" of the Long-Eared Kit show how remarkably he is equipped to detect the faint scamperings of wily rodent prey many yards away. He knows, too, the location of hidden rock basins or "coyote wells," where thirst may be allayed in a parched land. This fine photograph was taken at night in Death Valley





▲ PALMER THRASHER AT NEST. Enclosed in a fierce fortress of cholla spines, the blue-green eggs of the Palmer Thrasher are beyond the reach of most marauders. During the hot Arizona days these protectively colored birds dig in the scant shade, turning the pebble-strewn desert floor with their admirably fashioned pickaxe bills

▼ WESTERN MOURNING DOVE. As much at home as though wholly indigenous to the hot, thorn-carpeted plains of prickly pear, this young Western Mourning Dove nevertheless belongs to a highly cosmopolitan family. Its cradle might as appropriately have been on the furrowed, spreading arm of a northern cottonwood or hidden in the redolent pinelands of the Rockies. In the desert, paradox and contrast are commonplace



▼ HOME OF THE WESTERN RED TAILED HAWK in Giant Saguaro. A nest tree is not indispensable to the big Western



while still others lie torpid deep within underground burrows through the months of torturing heat and greatest water scarcity.

Reptiles, employing methods similar to the thorn- and spine-shielded cacti, guard their body moisture from thirsty sun and atmosphere under an armor of scales. Some dwellers here must confine their lives to the borders of springs and dependable seepages, the

Red-Tailed Hawks; a giant cactus will do as well. Adaptability, Nature's watchword, is doubly true in the desert



▲ DESERT SCALY LIZARD. With the quick start and stop of a jeep, a Desert Scaly Lizard scuttles over the hot, tinted rocks of the Painted Desert. Such speed is convincing proof that many dwellers here do not share our lethargy and exhaustion under the glaring rule of the torrid desert sun

YOUNG ABERT TOWHEE. This young Abert Towhee will spend his future rustling the dry leaves carpeting thickets of mesquite and arrowweed and the tall cottonwood groves bordering the winding Hassayampa. His kind include the busiest caretakers of woodland floors; and this species finds ample work to do in the long, narrow river bottoms threading the arid Southwest. Nature has a task for each of her children



miniature green paradises of the desert, while again a number of winged and four-footed inhabitants ascend to higher, cooler slopes with the advancing summer season. The habits of each, surviving in this fantastic environment, profiting from its hidden resources, taking advantage in odd ways of its bizarre protection, make a story of life that is both intriguing and exciting.

BOMBS

Unaccountable disturbances of the air, earth tremors, and spectacular sunsets told scientists that a mysterious cataclysm had occurred somewhere in Siberia; but years passed before explorers reached the scene and pieced together the story

from inter-stellar space



METEORS sometimes explode

By HOBART E. STOCKING

IN 1908, Dr. N. W. Shaw called to the attention of the British Association for the Advancement of Science a very peculiar type of micro-barograph record, one which showed unique oscillations of air pressure. He pointed out that stations recording the oscillations were located along a northeast-southwest line in south Britain. The northernmost station made the first record, and the passing air-waves reached the more southerly stations in succession.

Doctor Shaw's audience entered wholeheartedly into discussion of the phenomenon, but the combined knowledge of even so learned a gathering

was insufficient to supply an acceptable explanation. The barograph records, which had registered pulsations of atmospheric waves on June 30, 1908, were filed in the archives as an unexplained curiosity of meteorological science.

In Jena and Tiflis, seismographs had registered mild earthquakes on the same date. Calculations based on seismograph recordings located the focus of the tremor in Siberia, a region infrequently affected by earthquakes. Beyond this the incident occasioned no particular interest. In the days following, astronomers and meteorologists in Copenhagen, Vienna, and Berlin exchanged letters concerning the sudden appearance of spectacular bright

green, golden-red, and pure yellow sunsets of unique brilliance. In 1908, natural science was yet too inexperienced to recognize a relationship between such odd manifestations as singular barograph records, an earthquake, and brilliant sunsets.

Following the recording of the earthquake and during the next decade there drifted out of Siberia fragmentary reports of a most unusual incident, and by 1921 the curiosity of the scientific world was thoroughly aroused.

The piecemeal accounts told of a blinding flash in the sky, a thunderous deafening explosion, followed by a violent earth tremor—all these the chaos of an instant. Then the normal peace of

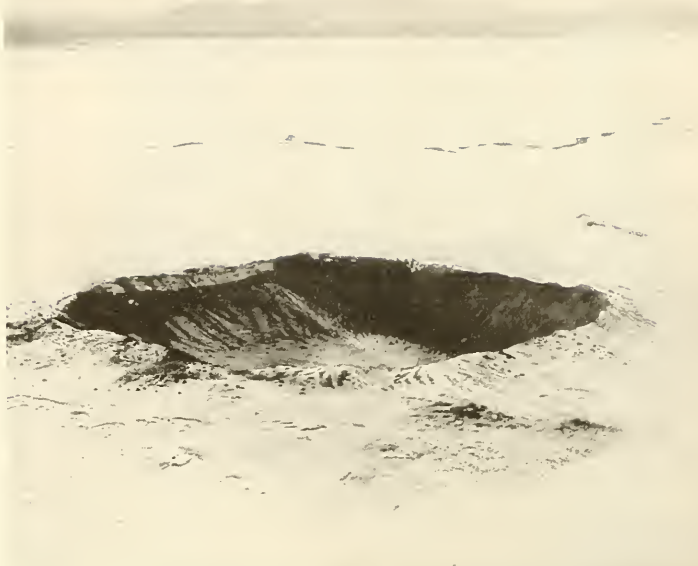
desert wastes had settled over the land.

Compilation of these fragmentary reports dated the event about mid-summer of 1908. Seismologists searched their records and found notation of the tremor of June 30 of that year. A British scientist, on reading a note regarding the incident, scanned his memory and came up with a recollection of unique atmospheric waves recorded in southern Britain the afternoon of the same date. Other scientists recalled the bright spectrum of sunsets in the days following June 30, a phenomenon which, at the time, they had attributed to volcanic dust from some remote eruption. But the vague reports out of Siberia spoke of a single cataclysm, and there was no intimation that a volcanic cone marked the locality.

From scientific evidence and the reports of observers it was the opinion of those interested in the mystery that the phenomenon must have been a visitation from the heavens—a meteor the like of which had never been experienced by modern man. It is small wonder that British scientists at the 1908 meeting were unable to explain the unique barometric waves—there was no existing standard for comparisons.

Soviet scientists set forth to track down the visitor from inter-stellar space. Three expeditions over a period of 10 years were necessary to collect meagre information, for the journey was not a simple one. Siberia presented hostile rigors to strangers, and the search led the explorers far into the north.

A stationmaster on the Trans-Si-



A.M.N.H. photo by Clyde Fisher

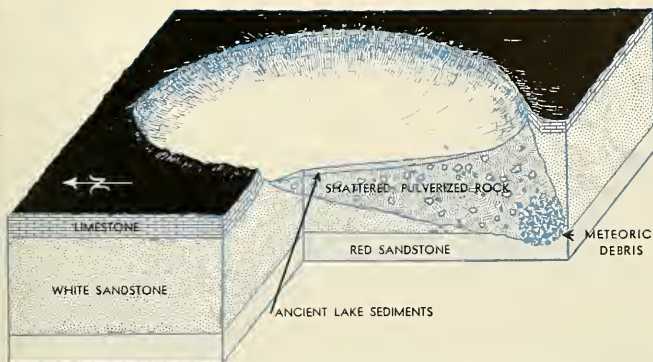
▲ THE LARGEST KNOWN meteor scar on the face of the earth is in Arizona. The crater is four-fifths of a mile across. All life in the region must have been instantly extinguished by the heat and shock

berian Railway recalled the incident. A train was due at his station, and on hearing an explosion and feeling certain that the train had been wrecked, he had rushed out to locate the debris. Journeying northward, the investigators encountered a man who told of

a blinding flash and sudden and unbearable heat, followed by a deafening roar and a blast of air that threw him from his high porch to the ground. When he recovered consciousness he found his home demolished.

Near Vanovera, a small settlement 400 miles north of the Trans-Siberian Railway and an equal distance south of the Arctic Circle, the searchers found a great cluster of meteor craters. Each was now a small swamp, 30 to 150 feet in diameter and 5 to 12 feet deep. Around each depression the ground was shattered, and rocks in the vicinity were folded into small wrinkles trending at right angles to a northeast—southwest line. This suggested that the meteors came from one or the other of these directions.

All evidence pointed to complete obliteration of life for miles around. Inhabitants of the region told of burned carcasses remaining from a herd of 1500 reindeer, and there were reports that entire families had been wiped out by searing heat and incredible concussion. Within a radius of 4.5 to 6 miles of the meteor craters, scorched trees were still standing. Around this and within a circle 18 to 24 miles in diameter, all trees lay pro-



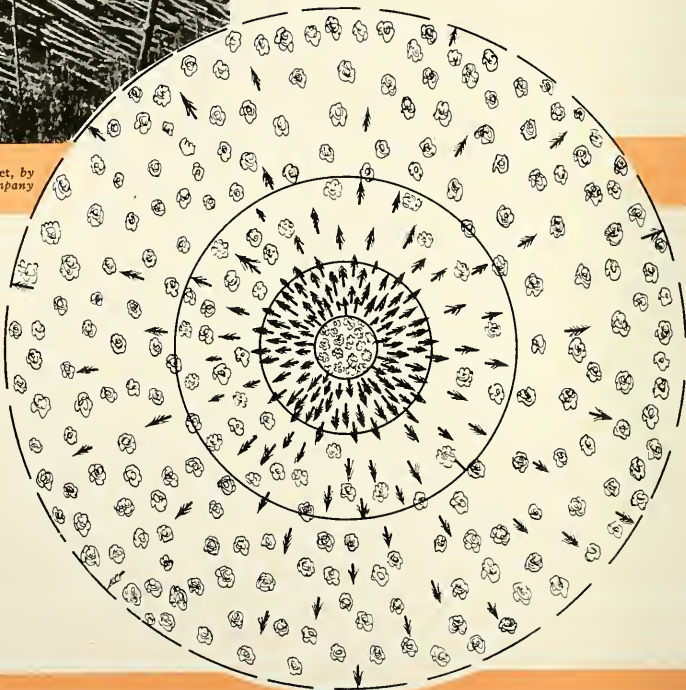
▲ THE ROARING, incandescent mass came from the north and plowed through more than a thousand feet of solid rock to form Meteor Crater, Arizona. Innumerable meteoric fragments have been found round about, varying from a fraction of an ounce to more than 1000 pounds. Drilling has indicated that the main mass is buried in about the position shown



Photo by Prof. Kulik, from *Our Stone-pelted Planet*, by H. H. Nininger, courtesy of Houghton Mifflin Company

trate with their tops pointing away from the craters. Within a third circle, 36 miles in diameter, many trees had been felled by the blast; and encompassing this was a fourth circle, 72 miles in diameter in which occasional trees had been laid low.

The central ring of standing trees in which the meteor craters were located marked a zone of mutual interference of air-waves produced by the impact. Within this area of approximately 80 square miles, trees blasted from one side were simultaneously struck by an equal force from the opposite direction. Supported by opposed forces, the trees remained upright amidst shock waves, any one of which might have felled the lot.



◀ TREES laid low by the tremendous Siberian meteorite "block-buster." The heat was so great that a farmer 50 miles from the place was afraid that his clothes would catch fire

▼ TREES were left standing near the center in the zone of impact, because they were simultaneously blasted from different sides. But in a ring from about 6 to 24 miles in diameter all trees lay prostrate, with their tops pointing away from the craters. Farther out there were progressively fewer felled trees

Three Kinds of Meteorites

STONE

STONE

STONY METEORITES, like this one from Long Island, Kansas, are the most easily crushed and appear to be the type that most frequently explode

STONE AND METAL

IN THIS STONY-IRON METEORITE the lighter parts are the iron network, while the dark parts are silicates

METAL

POLISHED CROSS-SECTION of a metallic meteorite: the beautiful Bethany specimen. Only one out of many million meteors that enter the earth's atmosphere reaches the earth to be examined like these



In the far north, a few feet below the surface, the ground remains solidly frozen the year around, and tedious excavation to a depth of 30 feet in brittle earth failed to encounter a meteor. But there was clear evidence that a "stick" of celestial bombs had struck the earth. All life in the vicinity had been snuffed out by these cosmic "blockbusters," and the impact had produced an earthquake of sufficient intensity to be recorded in Jena, 3240 miles away. The atmospheric shock-waves had traversed 3550 miles to produce the unique barograph records in southern Britain that were to remain an unsolved mystery for more than a decade. In the days following this celestial blow, dust from the passage of the meteors hung high in the atmosphere, converting rays of the setting sun into a brilliant spectrum that entertained and baffled scientists in northern Europe. Siberian natives, the Tungus, evolved a new religion centering about a visitation of the god Adgy (Fire) who had prostrated a virgin forest and plowed the earth in his fury. The site of this celestial plowing they avoided as a spot hallowed by an apparition.

On cloud-free, moonless nights a patient observer can count dozens of meteoric trains lacing the stars, and one of the many scientific tasks of the second Byrd Antarctic Expedition was the recording of these fireballs. Observers sat in frigid darkness in the Antarctic night, each watching a section of the heavens through a checkerboard of lines. As a glowing meteor

traced its course across the heavens an observer called out to a recorder the points where it appeared and disappeared on the "checkerboard," simultaneously checking time of transit through the atmosphere by a stop watch.

It was once believed that the incredible host of cosmic fragments that streak through the atmosphere were masses thrown from the moon by volcanic eruptions, and scientists were prone to regard this satellite as an unfriendly neighbor. A more recent and logical suggestion is that meteors have an origin similar to that of the earth. It is known that many swarms are regular members of our own solar system, but the paths of others suggest that they come from beyond the limit of our own cosmos—born perhaps of an exploding star. At speeds varying from 8 to 50 miles a second, meteors slip through the frigid realm of frictionless inter-stellar void, as cold and as invisible as the limitless space they traverse.

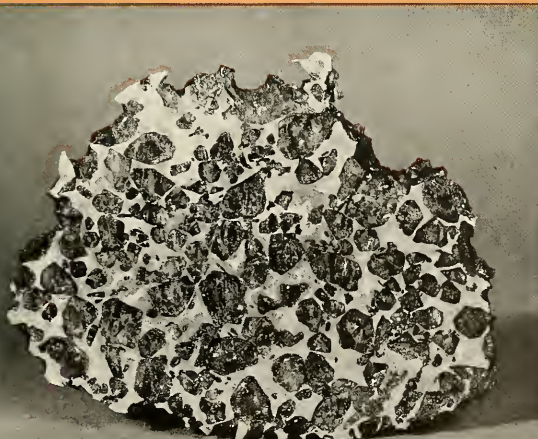
The earth is an elusive target. This planet moves about the sun at 66,600 miles an hour and with the sun through the galactic system at 43,200 miles an hour. But meteors are not aimed, they are merely deflected by circumstances which alter the delicate balance of universes. If chance, operating before there was a human being to count time, deflected a cosmic fragment, it might well be one properly directed to strike the earth today, tomorrow, a thousand or a million years hence.

Somewhere around 700 miles from the earth a meteor pushes aside scattered molecules of the outermost fringe of the atmosphere. At lower levels the air becomes progressively more dense, offering greater resistance to these bombs from inter-stellar space. With incredible momentum the meteor compresses the air before it, and with compression comes heat. This heat is imparted to the meteor, and from the temperature of outer space, somewhere near absolute zero, its surface rises rapidly to incandescence. Thus is produced the familiar and ever-inspiring spectacle of a ball and filament of fire streaking the heavens.

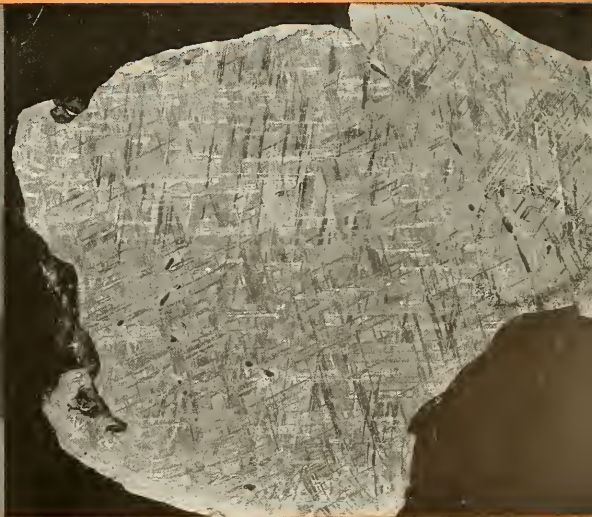
The heat is so intense that small meteors may be completely vaporized. It has been calculated that a meteor of about 10 pounds is the minimum mass that could survive the heat of transit through the atmosphere. Incandescent heat converts solids to vapor, and meteors at white heat constantly lose part of their mass by vaporization. The vapor of meteors, deprived of heat by reduced velocity, rapidly condenses to dust, which settles from the upper atmosphere. Every day the weight and volume of the earth is increased by scores of tons of meteoric dust.

Meteors may travel as individuals, as members of a closely spaced group, or as scattered units of a vast swarm in which the last members trail thousands of miles behind the foremost in their colossal sweep through space. The Leonids belong to the latter type. Every year, about November 13, some

STONE AND METAL



METAL



of them streak through the earth's atmosphere. Passing through in a direction opposite to the motion of the earth, at a velocity of 44 miles a second, they weave white streamers across the skies. So meticulous is the organization of the cosmos that at intervals of 33 and a fraction years the earth passes through the densest portion of the Leonid swarm. In 1833 their number and brilliance frightened the citizenry of the entire eastern United States. An estimated 200,000 meteors, ranging from pin-points of light to bodies comparable to the apparent size of the moon, zipped past in a period of nine hours.

The Andromedid swarm of meteors, now no longer seen, overtook the earth between approximately November 17 and 27 each year, passing our planet at 11 miles a second. With lower velocity these meteors attained lower temperatures and left less brilliant yellow trains to mark their passage.

Meteors have always bombarded the earth. To mankind they are objects of veneration, terror, and interest. The "Black Stone" of Mecca, is a meteorite which has been an object of reverence to Mohammedans for centuries. Meteor fragments that reach the hands of scientists are dissected by chemical analysis and microscopic examination in the search for news from other worlds. They show marked differences in composition, a fact which suggests that they do not all have the same origin.

Meteors that reach the earth are spoken of as meteorites. Such terminology sometimes confuses laymen, but among scientists it distinguishes the bodies which have been or can be examined at first hand from those which scientists would like to examine but cannot so long as they continue their restless journey through cosmic space.

Some meteorites, the Siderites, are composed chiefly of iron with 10 per cent, more or less, of nickel. Others, the Siderolites, are a mixture of iron and stony matter. Aerolites, a third type, are almost wholly stony matter. Just as terrestrial materials differ in weight and strength, so do fragments of other worlds. Of the three types of meteorites, aerolites are most easily crushed.

In thin air 12 miles above the earth, a meteor moving 27 miles a second is subjected to a pressure of 10,000 pounds on each square inch by the resistance of air to compression. A meteor the size and shape of a modest hand, with a velocity of 27 miles a sec-

ond at 12 miles above the earth would sustain a pressure of half a million pounds. Closer to the earth denser air would offer even greater resistance. Fireballs have been observed to explode once, twice, even three times, and the fragments, deprived of speed, drop to earth as dark stones. Almost invariably, fragments of exploded meteors are of the aerolite type.

At 4:08 A.M., February 17, 1930, a brilliant meteor appeared over Evansville, Indiana. Moving southwestward it spanned a corner of Missouri in the time of a quickly drawn breath. Two young fishermen near Paragould, Arkansas, caught a brightening in the sky behind them and turned to see a glowing mass flash out of the northeast and disappear in the southwest. Other observers reported that the meteor burst into three fragments which dropped to earth near-by. One portion later recovered was an aerolite, weighing 745 pounds, the largest stony meteorite ever found.

Siderites, strong heavy masses of nickel-iron, reach the earth intact but fluted and scarred by the incredible heat (calculated to exceed 3000° C.) generated by the speed of their passage. So great is the resistance of the lowest and densest layer of air to meteoric velocities that even great masses do not usually strike the earth with much force. A 70-ton nickel-iron meteorite that fell at Grootfontein, Southwest Africa, buried itself in limestone to a depth of only 5 feet. But our celestial visitors are not always so gentle in their contact with the earth, as evidenced by the havoc of the Siberian meteor swarm.

Very probably there are scores of meteoric scars on North America, but such features are measured by only a few thousand square feet on a continent scaled in millions of square miles, and they remain microscopically inconspicuous. Also, there are other agencies which form similar depressions, and the meteoric origin of a "crater" can be confirmed only by discovery of actual fragments of celestial missiles. Meteor scars are most frequently found in arid regions, where erosion processes allow the scars to remain unhealed. Also, the absence of forest or brush tends to render them more conspicuous.

There is a small meteor scar near Haviland, Kansas, and there are five near Odessa, Texas. The largest of these latter is 500 feet in diameter. Excavation in the depression shows that the original crater was 50 feet

deep, but ages of sandstorms typical of the region have filled it with wind-blown sand and dust to within a few feet of the original surface. In the desert of central Australia there is a cluster of 13 meteor craters, the largest of which is an oval 660 feet long by 360 feet wide and 50 feet deep.

In Arizona, between Flagstaff and Winslow, there is a meteor scar of incredible size, so large as to dwarf all other known examples. This topographic feature was formerly named Coon Butte, although it differs in form from the normal butte of the West. In recent years its fame has spread throughout the scientific world under the name of Meteor Crater. Nearly 4150 feet in diameter and 570 feet deep, with a rim of upturned rocks rising from 130 to 160 feet above the surrounding plain, Meteor Crater is enduring evidence of a cosmic blow that must have jarred the entire earth. For years the actual nature of the bowl-shaped depression went unrecognized, but in recent years thousands of meteoric fragments, weighing from a gram to more than 1000 pounds, have been found in the vicinity. They are of the nickel-iron type, and this fact, together with the incredible size of the crater, led enterprising speculators to attempt a mining venture.

Churn-drill holes sunk in the center of the bowl penetrated more than 100 feet of ancient lake-deposits and several hundred feet of pulverized rock before encountering normal bedrock and without locating the meteorite. Those who argued against meteoric origin for the crater seized on this as strong supporting evidence, but proponents suggested that further investigation was warranted.

Unbiased but keenly interested geologists pointed out the significance of the lake beds. The region of Meteor Crater is now a desert and the depression itself is dry. Scattered throughout arid western areas there are many dried-up lake basins, some of which contained bodies of fresh water nearly as large as Lake Michigan. The present Great Salt Lake is the concentrated remnant of a vast and ancient body of fresh water. These ancient lake basins and the lake sediments of Meteor Crater suggest that the area, now a desert, once enjoyed a rainfall at least equal to that of the Great Lakes region today. Furthermore, the meteor struck the earth before the climate of the region changed to an arid one, and for a time the Crater held a lake.

Continued on page 48



WINTER

through the Camera's Eye

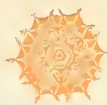
By JOSEF MUENCH



▲ VIGIL OVER THE DIVIDE. A sturdy pine tree which keeps watch over the snowy crest of the California Divide, seen from Morro Rock in the Sequoia National Park

WINTER THROUGH THE CAMERA'S EYE





▼ WINTER FANTASY. Under a cap of snow even the little streams are transformed into fairy places. Here the Kaweah River winds its way through Sequoia National Park





▲ SNOWSCAPE. Evergreen bows have turned to silver, and the mountains have donned their snowy coat for the skier who would brave the crisp weather. Greenhorn Mountains, Cal.



▲ FOREST IN WHITE. Winter comes to the trees and brings them a fresher, gayer appearance, while it mantles the ground in its silencing, brilliant robe

▼ WINTER REFLECTIONS. An unusual camera shot of the eastern scarp of the High Sierra reflected in a warm pool of water in Owens Valley, in eastern central California





▲ **WINTER ON THE DIVIDE.** The mighty saw-tooth peaks of the Western Divide are seen in their winter dress from a snowy slope on Alta Peak, in Sequoia National Park

▼ **THE SHARP EAST WALL** of the High Sierra in winter dress. Owens Valley wears a robe of white, and the snow on the eastern scarp is echoed in the fleeting clouds



THE WAR AGAINST MALARIA

At a time when our armed forces need it most, the tree that has saved millions of lives is almost entirely in enemy hands

◀ THE BLOSSOM of the so-called "fever tree," whose bark yields the medicine that prevents and cures malaria

Black Star photos

By HAROLD N. MOLDENKE

IN the steaming jungles of the Solomons and the dank forests of New Guinea, on the dark miasmatic rivers of Burma and the wild shores of Guadalcanal, the foremost enemy of the American troops is not the Japanese, but *malaria*! General MacArthur has reported that the Battle of Bataan was lost not only through lack of ammunition, but also through lack of means of fighting the malaria, from which 80 per cent of his front-line troops were suffering 10 days before Bataan fell.

To the soldiers stationed in the Canal Zone, in Trinidad, in Guiana, and Brazil—to the hundreds of thousands of rubber-tappers and their families in the dense jungles of the Amazon—malaria is a far greater danger than venomous serpents or ferocious beasts of prey!

Malaria kills about 3,000,000 persons throughout the world each year, and there are at least 800,000,000 cases of malarial fever. In the war effort of the United Nations this

▼ BARK of the cinchona tree, famous since the earliest days of Spanish colonization in South America. It has for three centuries been the standard weapon against the disease that attacks and kills more persons annually than any other





deadly fever is becoming increasingly more menacing as the number of men stationed in tropical malarious regions increases.

The war against malaria is an unending battle against three (perhaps four) types of protozoan parasites of the genus *Plasmodium*, which pass one part of their life history in the *Anopheles* mosquito and the other part in man. When the parasite gets into the human body it enters a red blood cell, where it promptly multiplies (without sexual processes) until the cell bursts, releasing the parasites and the stored-up poisonous prod-

◀ PROSPECTORS estimating the value of future cinchona plantations in the Netherlands East Indies. The region that produces over 95% of the world's quinine supply is now held by the Japanese

Netherlands Information Bureau photos



▲ A CINCHONA PLANTATION near Bandung, Java, center of our prewar source of quinine. Originally

found only in South America, the plant was transplanted to this ideal locality within the past century

ucts. The released parasites enter other blood cells and repeat the process. The toxic materials enter the serum of the blood and are distributed throughout the body, causing chills, fever, digestive disturbances, loss of strength, frequently collapse, and in many cases death.

Among the parasite's vast progeny there is always a small percentage, called gametes, which are male and female and cannot reproduce separately. These remain in the blood cells in a quiescent state. If a mosquito, in biting a patient, draws some of these gametes into her stomach,

► NATIVES felling a cinchona tree in Java. About ten years are required for a tree to attain peak content. New trees are therefore planted in rotation

▼ THOUSANDS of young women debark the tree trunks in the quinine forests of Java



Dée Bredin photos from *Black Star*



they will start reproducing by sexual processes and will produce offspring that can reproduce asexually if injected into another human being. The gametes live only about one month, but any time a person suffers a "flare-up" he becomes a potential carrier of the disease. In addition to the victims who die, many others who have caught it continue to suffer its effects for years. In some tropical re-

gions it is estimated that $\frac{1}{3}$ to $\frac{1}{2}$ of the population has malaria.

Man's only remedy against malaria for three centuries has been quinine, extracted from the bark of the *cinchona* (pronounced *sin-ko'-na*) or "fever trees" of South America. Cinchona was apparently known to the shamans or priests of the Inca empire long before the coming of Europeans to the New World and was known

as *quina-quina*.¹ The discovery of its medicinal values certainly ranks as one of the major events in the history of the New World.

The story of the arduous and danger-fraught search for the best cinchona trees by the famous naturalist-explorer, Richard Spruce, and others, forms another romantic chapter in the history of quinine. Success was finally achieved about 80 years ago when Charles Ledger, an Englishman who had lived in Peru and Bolivia for 20 years, obtained 14 pounds of a very superior strain of cinchona seeds. Failing to interest the British Government in his project, he sold a pound of these seeds to a Dutch Government official, who took them to Java. This was the humble beginning of Java's quinine industry in the Preanger Mountains, through which, in time, Java was able to supply the world's annual quinine requirement. In peace time this amounts to 650-750 tons, in war time (1941) 1017 tons.

¹ That the Incas used the remedy first is sometimes disputed. If they did not, the early Jesuits must have discovered it on their own.

▼ FIRST STEPS in the program to develop Western Hemisphere sufficiency in quinine: a Department of Agriculture worker planting seeds at the plant introduction station at Glenn Dale, Maryland. The seedlings will be shipped to Central and South America. One-year-old seedlings are seen in the right-hand tray, two-year-old plants in the pots

United States Dept. of Agriculture photos by Knell



▲ NOTCHING a cinchona plant to encourage budding

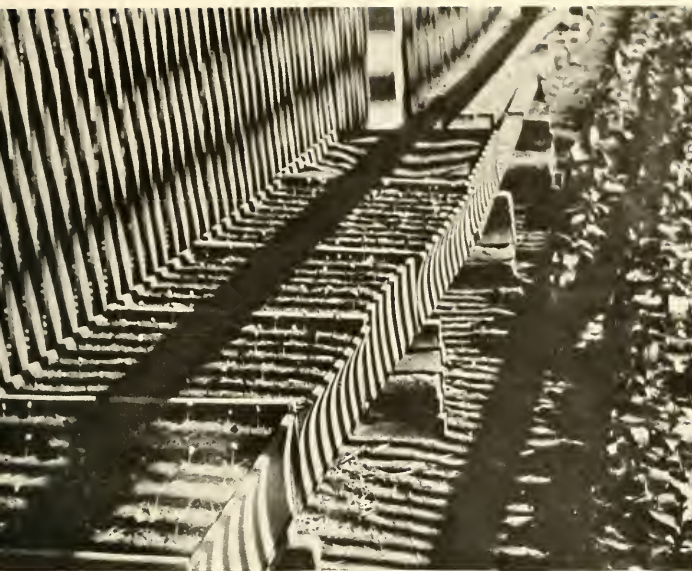
▼ FOR THE GOOD HEALTH of our men in the tropics: quinine being weighed and wrapped. In peacetime 650-750 tons of quinine were required yearly. War needs increased the amount to 1017 tons in 1941

Photo by Ewing Galloway, N. Y.

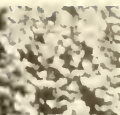


Cinchona is a large genus of plants, most of which are native to the forests on the eastern slopes of the Andes from Colombia and Venezuela southward through Ecuador and Peru to Bolivia. Peru alone has some 75 species, of which at least 15 have been used for their bark. Although about 90 per cent of the world's supply before the war came from the Dutch East Indies or was distributed through Dutch interests, cinchona cultivation has also been undertaken on St. Helena and in the Cameroons, Tanganyika Territory, Malaya, Madras, and Bengal; but numerous failures have been reported. After Java was overrun by the Japanese, the Dutch took measures to render the factories useless. Now frantic efforts are being made to locate cinchona trees in their original homes and develop a quinine industry in Latin America which will make the New World independent in regard to this strategic drug.

Farsightedly, in 1920, the Director of Forestry in the Philippines bought a pint of cinchona seeds for \$4,000. Before the fall of Bataan, 2,000,000 precious seeds were brought back to the New World from the Philippines. More than 100,000 seedlings are now ready to be planted on 10,000 acres in Costa Rica. The most favorable areas there are from 4000 to 6000 feet above sea level. Cinchona does

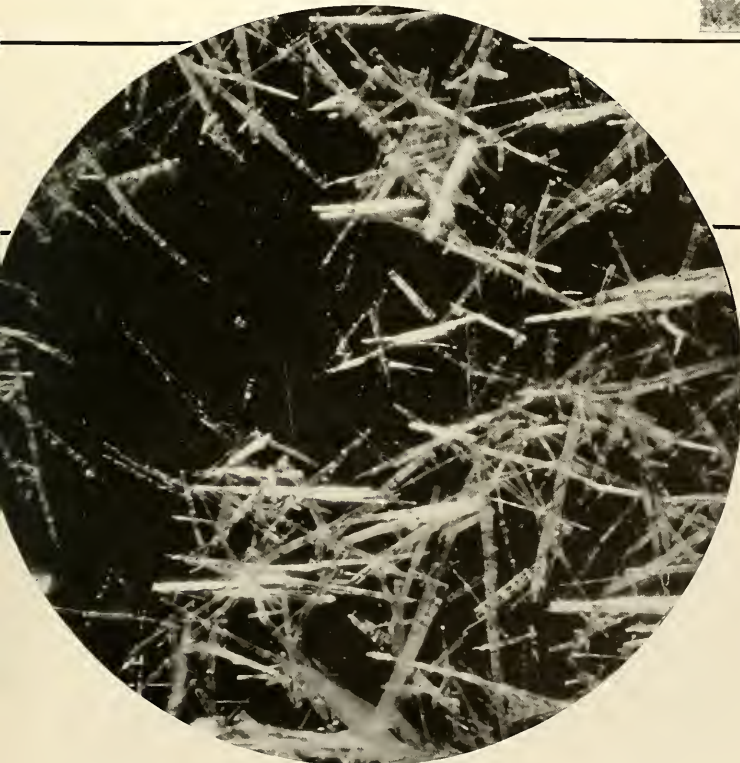
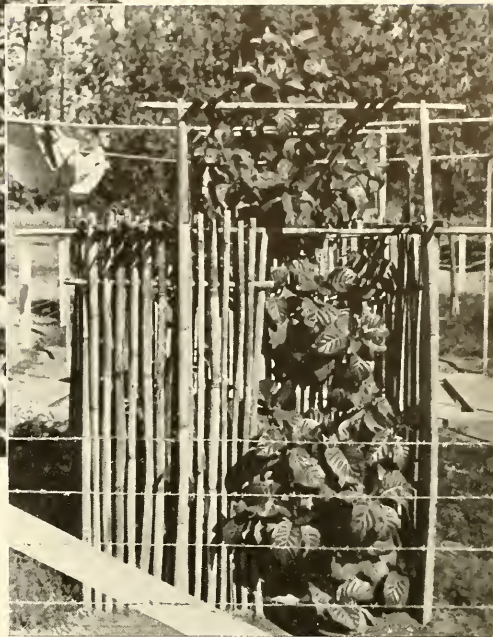


▲ PROGRESS toward new sources of quinine in South America: seedlings of cinchona growing in a nursery at the Egronomico (Agricultural Experimental Station) near São Paulo, Brazil. The shadow of the bamboo fence falling on the tender plants protects them from too much sunlight



▼ A MORE MATURE cinchona plant growing at the Egronomico at Campinas, Brazil

Three Lions photos



◀ DELICATE WHITE CRYSTALS of quinine derived from cinchona bark, as they appear under the microscope

Block Star photo

best where the dry season does not exceed a month and a half. Seedlings are already growing in Brazil, and plantations have been started in Mexico, Venezuela, and Colombia. The greatest present activity in this respect is in Guatemala, where 3,000,000 seedlings have been distributed and 300,000,000 more seeds are being planted. The establishment of such new plantations, of course, will not produce quinine in time to assist in the present war effort, but is part of a long term project for the development of a permanent New World quinine industry.

Chemically quinine has the formula of $C_{20}H_{24}N_2O_2$. Cinchona bark contains not only quinine, but also

quinidine and certain other white crystalline alkaloids, especially *cinchonine* and *cinchonidine* ($C_{19}H_{22}N_2O$). Quinine is fundamentally a protoplasmic poison and if taken in too large amounts will break down the protoplasm of the human body instead of just the protozoa which cause malaria. It is usually administered in the form of quinine sulphate.

Two chemical compounds have been developed synthetically which are helping to replace quinine. One, *plasmochin* (or *plasmoquine*), announced in 1924, will not kill the protozoa which quinine kills, but will kill the quiescent gametes. The second is *atabrine* (or *quinacrine hydrochloride*), announced in 1933, which will kill the asexual stage. Other compounds on which work has been done are undecane diamidine, stilbene diamidine, promin, and sulfadiazine. However, the synthetics, while representing a distinct forward step in malarial therapy, can never completely replace real quinine, because the latter may be taken by anyone without a doctor's care or prescription, while strict medical supervision is generally essential in taking the more dangerous synthetics.

The cinchona bark obtained from South America does not contain as much quinine as that from Japanese-held territory because years of careful breeding and selection have contributed to the high-content strains of the Dutch East Indies. However, other components of the South American bark with antimalarial action can be inexpensively and efficiently extracted to augment our supply of antimalarials.

The delicate white crystals of quinine are not the only product of worth that is extracted from the bark. Other active medicinal substances are also procured. The yellowish-brown powder called *totaquine* is a well-tried and reliable agent capable of replacing quinine in almost all instances, although it is only about half as potent, requiring doses of 30 grains a day. Totaquine will probably largely replace quinine in the United States during the present war while precious quinine stocks are shipped to the armed forces. Like quinine, under present governmental restrictions it may be used only for the treatment of malaria. Totaquine has thus far not been rendered stable enough to allow its shipment to fighting fronts. The huge army of *cascarilleros* or

quinine gatherers in South America must also have their antimalaria medicine while gathering the bark. Some 45,000,000 tablets of atabrine are being reserved for them. Atabrine is now being produced at the rate of about half a billion tablets a year, although many doctors still prefer natural quinine to atabrine synthesized in the laboratory.

The bark of the Ecuadorean "fever-tree" was for a long time surreptitiously added to the more expensive bark of the Peruvian balsam (*Myroxylon peruiferum*). The name "Peruvian bark" clung to cinchona even after it was separated from the balsam in commerce. For two centuries the only source of cinchona was the forests of the eastern Andes from Colombia to Peru. Increased appreciation of the tremendous medicinal values of the drug led to increased demand. This, in turn, led to the establishment of the Dutch plantations and, in 1859, to the extensive program for cinchona plantations in British India. Originally all the quinine came from *Cinchona officinalis*, but in recent decades *C. ledgeriana* has provided almost the entire supply. Quite a different species, *C. succirubra*, has bark which rarely yields more than 2% or 3% of quinine. It is mainly used as a stock plant on which to graft the less vigorous *C. ledgeriana*, which averages 7% or more of quinine in its bark.

Cinchona trees are not easy to grow in cultivation, since their soil and climatic requirements are quite exacting. They must be several years old before any bark can be harvested, and peak production is not attained until they are ten years old. In harvesting, the entire trees are uprooted and the bark is removed by beating the trunk, larger branches, and roots with wooden mallets and stripping by hand. After the trees have reached a certain age the increase in quinine content slows down considerably. For this reason most plantations operate on an 8-, 10-, 15-, or even 20-year rotation, depending on whichever time-period will bring the most efficient harvest in a given soil and climatic environment. An 8-year schedule, for example, means the cutting down of one-eighth of the total acreage annually and the replanting of an equal amount of young trees. After stripping, the bark is dried and ground to a coarse powder for shipment to the manufacturers, who extract the

quinine and other chemically desired alkaloids.

In recent years shipments of quinine to the United States have averaged over 1,700,000 pounds annually, valued at \$735,000. About 98% of this came from the Dutch East Indies, but the cinchona industry never really died out in the New World. Bolivia, for instance, has had quite a thriving industry for many years and in 1938 exported about 2,000,000 pounds of the bark to Europe. Plantations which were made many years ago in Ecuador, Colombia, and Guatemala still exist.

The original cinchona bark of European and American markets was in the form of "quills." These are narrow strips of bark, which roll up in drying. They were used not only to extract quinine for treatment of fever, but also to a lesser extent in other medicines, for the medication of wines and other beverages, in toiletries, and for culinary purposes.

Exploring botanists are discovering great numbers of wild cinchona trees in sections of South America where they had not previously been known to exist in commercial quantities. In Ecuador alone there are said to be some 10,000,000 wild trees. The transportation of the bark from the depths of the jungles is a fascinating story filled with romance and danger. The bare backs of natives, mules, hand-propelled river barges, railroads, ships, and even airplanes all figure in this story. Recently an urgent request for an outboard motor was telegraphed to Washington, and the motor was rushed down to Peru by air mail to test the feasibility of moving bark along a certain inland river on an outboard-driven barge. A hitherto undeveloped stand has been located in the Balsapampa region of central Bolivia. Because there are so few trails into this remote area, the regular method of penetration has been on rafts, along the rivers. Plans now call for clearing a landing strip for airplanes in the midst of the forest. An exploring party entering the region by plane returned in 45 minutes, but it took 22 days for some of the bark to be brought out on foot by the Indians!

So the tentacles of War are reaching even into the most isolated and hitherto inaccessible jungle lands of central South America!

[Next month: Other plants that yield drugs and medical supplies.]

FARMING AT TEN FATHOMS

By CURTIS ZAHN

A NEW kind of Victory Garden is being harvested off California and Mexico today. It grows the year round, needs no tending, and is anyone's for the picking—but farmers must wear diving suits because it lies on the ocean's floor.

The crop is called "gelidium." It is a delicate red alga or seaweed that must be hand-picked from rocky crags in 20- to 60-foot depths, usually in turbulent water. It is used for making agar-agar, 92% of which was formerly imported from Japan, at 25 cents per pound. Now it is frozen at a United States ceiling price of \$3.00 per pound.

Agar's part in the war effort is of vital importance. Formerly it was used for many "luxuries." It once gave ice cream its smooth texture and was used similarly in cheeses and candies. It was utilized in limited quantities in photographic film. Containing absolutely no food value, it served as a laxative and an aid to chronic constipation. It was even used for dental impressions, and as a housewife's friend in "thickening anything," as well as for making silk and paper transparent.

Today, of course, it is a priority item. This is because of its unique properties as a substance for the growth and study of bacteria. Mixed with beef extract, agar forms a nutrient jelly which will not turn liquid under working temperatures and which responds better under bacteriological use than any other known culture medium. The great role of agar today is in the diagnosis of infection, in the testing of water and milk, and in various other related ways. The Government is therefore restricting the use of agar to scientific and strategic purposes.

Until the war, the only American company struggled and failed. Today, that company—in San Diego, California—is operating on a 24-hour basis every day and producing 200,000 pounds of the valuable jell per year. This is some 400,000 less than the former annual import from Japan, but there are many reasons.

First, it takes roughly 150 pounds of gelidium seaweed to produce 18

pounds of agar, and it is a day's work for one diver to harvest from 300 to 1000 pounds of the seaweed. There is also the fact that weather conditions do not permit operations between October and March. Often the diving boats spend many days trying to locate good beds, and often the water is not clear enough for work. The overhead from operating boats and capable workmen is something again in a country where man power is at a premium.

But there are arguments on the credit side. Thirty boats are operating under the flag of Mexico to aid a similar number in California. And two laboratories of the Fish and Wildlife Service and at least a dozen State and private institutions are attempting to develop new sources of supply. The "scientific" method of producing agar in the United States takes but ten days, while in Japan the material undergoes a cheaper "nature" processing which takes six months. Eventually, it is believed, Allied agar output will win the race.

The curing process is interesting. In Japan, where agar was used for jelly hundreds of years ago, the seaweed is harvested along the Asiatic coasts by girl divers, and taken to the mountains. There it is frozen in snow and thawed by spring sun, then ground up for shipping. In California—the only other coastal area producing gelidium—the crop is brought ashore by the boats, dried, and shipped to the refining plant. Here it is soaked in water and then cooked for 48 hours. In a form resembling an amber syrup it is piped to tubs, where it solidifies at room temperature. The rubbery substance is then dumped into refrigerator vats and frozen into brown blocks. From this stage—having undergone purification and having been relieved of excess water content—it is dried, bleached, and ground. The finished agar looks something like a cross between cornflakes and rice.

All in all, agar is many things; but it may be a long time before the public sees it again in any quantity. When that time comes, experts believe that it will bear the trade-mark, "Made in America."



*Natural
History*

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Ahose illustration—Nile River Group—Detail showing Antelope
Akeley African Hall—American Museum of Natural History



Who —

▼ KOALAS at Koala Park, Sydney, Australia

Photograph by Russel Roberts



ME?



Photograph by Fisher

▲ HAMSTER: a rodent of eastern Europe and western Asia

▼ A FOX in Switzerland, whose puzzled expression clearly displays curiosity over the cameraman

Photograph by Steiner





Photograph by A. King

▲ A LEMUR; an animal related to the monkeys, whose large eyes are an advantage in the nocturnal life it leads



Photograph by Bird

➤ SNOWY OWL: a bird of the northern latitudes. Only its talons are free from the close warm covering of plumage, which covers even its nostrils



Careful study of the attitude of rocks around the rim of Meteor Crater and subsequent drilling on the south side afforded information which is generalized in the diagrammatic sketch reproduced with this article. The mass of meteoric iron (and it must have been a compact cluster of relatively small fragments rather than a single mass), roared out of the void of dark space. It came from the north and the speed of its passage converted it to a

roaring incandescent mass. It struck the earth at a low angle, plowing through more than a thousand feet of solid rock with a violence that jarred the atoms at the earth's core. If there was life anywhere in the region it must have been instantly extinguished by searing heat and devastating concussion. It was the greatest cosmic fragment ever known to have struck this planet, and it is a mathematical certainty that the earth has never been quite the same since that day, for the resultant path of two bodies in collision is not quite identical with the path

that either followed before the moment of impact.

Every day many millions of meteors enter the envelope of atmosphere that surrounds the earth. Of this prodigious number it is estimated that an average of one strikes the globe each day. At this rate, more than 700,000 have struck the earth since the birth of Christ. It is fortunate for the human race that they do not all have such devastating effect as the Siberian missile, else there would be no reader of *NATURAL HISTORY* remaining to report the one that fell today.

Service Men Can Catch Strange Fish

THE service man abroad who misses the old fishing ground back home can now enjoy his hours off duty with a pocket-size kit containing tackle to catch anything from a minnow to a sea turtle. Fish that fly through the air and fish that wriggle overground will be commonplace in regions occupied by thousands of our men.

Recreation, relaxation, and added variety in diet will be provided through this scientifically designed kit. It will also no doubt encourage the natural interest in wildlife which many an American enjoys, enabling him to gain a wider knowledge of the strange lands in which he is stationed.

Service men had been observed fishing with bent nails and anything else they could improvise on some of the world's finest fishing ranges—rivers, lakes, and shores of the seven seas. The kit which was developed as a consequence is a marvel of ingenuity and compactness. Instructions on waterproof paper give many tricks and tips for the fisherman who finds

himself in unfamiliar waters, including ways to distinguish the edible from the inedible.

In designing the kit Mr. Lerner, Vice-President of the International Game Fish Association, which has its headquarters at the American Museum of Natural History, was assisted by Philip Wylie, also an officer of the Association. Civilian anglers have contributed over \$60,000 toward the purchase of the kits.

They are being distributed throughout the world by the Red Cross, and the Special Service Division of the War Department has placed a large additional order. The aim is to make tackle available to every fighting man who cares to try his luck in his off hours.

A MARVELOUS VARIETY of equipment is included in the new pocket-size fishing kit for service men. Instructions are given on how to make the acquaintance of many of the curious creatures that will engage the attention of soldiers, sailors, and marines interested in the wildlife of their distant outposts



WALKER PRIZES IN NATURAL HISTORY

An essay contest in which two prizes of \$60 and \$30 respectively are offered is announced this year as usual by the New England Museum of Natural History. Any subject in the field of mammals will be eligible. Each paper must be the result of original and unpublished research personally conducted by the author. In case of exceptional merit the first prize may be increased to \$100. Interested readers are requested to send for an application blank from the New England Museum of Natural History, 234 Berkeley Street, Boston 16, Massachusetts.

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INFANTILE PARALYSIS FUND**



February **NATURAL HISTORY** 1944

Dinosaur Tracks • Beaver Conservation • Winter Birds

Strategic Woods • Passenger Pigeon • Pet Mongooses



Model of a Maya Temple, Rio Bec B, Campeche, Mexico—A.M.N.H. photo.

OUR NEIGHBOR—MEXICO

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Science and Social Understanding

THE postwar world is the subject of the day. The press, books, debates, and forums discuss the problems that peace will present, and raise high hopes for a saner and better world. The war and social upheaval have shaken loose convention and custom, and new conceptions for universal peace and progress for mankind appear to be in the making.

Ideas and ideals for these great ends are put forward in the main by men of affairs in terms of politics and economics. What about the Natural Scientists? Should not these leaders of thought influence the formulation of plans for this world of tomorrow?

Biologists are aware of instincts that are part of Man's nature in his million-year development and question whether these should be thwarted by political structures—instincts for personal acquisition, family protection, spiritual outlet.

Ethnologists are students of contemporary peoples—black, yellow, and white—and have ideas on how far our Atlantic Basin civilization can and cannot be imposed on cultures different from our own. Ethnologists are believers in fundamental similarities in the abilities and characteristics of mankind, irrespective of race or color.

Geneticists, taking stock of biological man and disturbed by signs of deterioration caused by modern civilization, advocate educational drives for the physical improvement of human stock, as well as restrictions to prevent the reproduction of diseased and degenerate people.

Anthropologists have surveyed the great civilizations that have flourished and disappeared during the past ten thou-

sand years since Man ceased to be a Nomad and can point to the harmful effects of overemphasis on urban development and overcentralization of government.

Geologists and Agriculturists study the causes and remedies for soil exhaustion and other wastes of natural resources and should have answers for these problems.

All these Natural Scientists would propose radical changes in an educational system which virtually ignores the essential study of Man and his environment.

Although the foregoing ideas attributed to the Natural Scientists are controversial and may not all be generally accepted, they are thought-provoking and should form part of that general body of fact and informed opinion upon which action is based. The subjects—human instincts, races of mankind, human stock, civilizations, natural resources, education—are certainly inherent in any discussion for the betterment of mankind, and the co-operation of the Natural Scientists in their discussion is very important. Why is not such co-operation sought and offered more freely? The reason is partly that the scientist is disinclined either to generalize or popularize. And the man of affairs is apt to be ignorant of scientific thinking on these subjects and rather scornful of the scientist. But the long course of history proves the limitations, shortcomings, and often the entire failure of action taken without factual knowledge and informed opinion.

Today's discussion will crystallize in tomorrow's action. Let every encouragement be given for the Natural Scientists to take their proper part.

A Perry Osborn

*First Vice-President,
The American Museum of
Natural History.*

A NEW RESOURCE HAS BEEN DEVELOPED

THE WEALTH of America has been wrought from her natural resources of fertile lands, wide forests and rich mineral deposits by the brains and muscles of her people.

But another resource is now available. A new source of wealth and well-being has been developing gradually and almost unnoticed which is tremendously important today and of still greater importance for tomorrow.

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These are the procedures of research. Its consummation is the grasping by subtle minds of relationships in nature no one has previously known. And on the basis of the broader knowledge so established are built new materials, new methods and new structures to serve the people of America.

The Bell Telephone Laboratories has now concentrated its efforts on communication systems and equipment for the armed forces. When the war is over its researches in communication will again be applied to an ever-improving telephone service in America.

BELL TELEPHONE SYSTEM



NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ALBERT E. PARR, Director

VOLUME LIII—No. 2

* * * * *

FEBRUARY, 1944

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LETTERS



Natural History

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Above illustration—Nile River Group—Detail showing Antelope
Akeley African Hall—American Museum of Natural History



THE SLENDER ARCH in the center of the photograph above looks like something that might be destroyed under the heel of a passer-by or obliterated by next season's snow and ice. The arch is in reality so large that a football field could almost be put under it lengthwise, the span being 291 feet long. Thus a bird's-eye view

frequently shows that the mighty works of Nature are in reality infinitesimally small marks on the face of our planet. This unusual airplane view was submitted by Mr. George Collins for comparison with the close-up photograph below, published in a previous issue of NATURAL HISTORY.

Photo by Hubert A. Lowman





SIRS:

The accompanying photograph shows an unusual location chosen for the nest of one of our common social insects. This nest of a paper wasp was built under the reflector of an outdoor electric light. The bulb had been missing for some time, so the wasps started to build in the socket and then expanded their nest close to the under side of the reflector. The location gave them perfect protection from sun, rain, and wind. . . .

Out of the 200-odd magazines to which our College Library subscribes regularly, I can really say that *NATURAL HISTORY* is one of my favorites. . . . I wish the Museum were closer, so that I could visit it again, for I didn't see enough during the three summers that I lived in New York and spent many days each month roaming through its wonderful halls.

(THE REV.) JOHN W. BAEGLE.

St. Joseph's College,
Collegeville, Indiana.

SIRS:

. . . Your pictures are always of absorbing interest, but in these days of paper shortage I, for one, would appreciate fewer illustrations and more text. "Reading maketh a full man, conference a ready man, and writing an exact man," wrote Bacon, and he might have added that looking at pictures leaves you right where you were.

LEONARD ORMEROD.

Hartford, Michigan.

Continued on page 96

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THE COVER THIS MONTH

A detail from the Mule Deer habitat group recently opened to the public in the American Museum forms the cover design of this issue. The Mule Deer gets its name from its very large ears; but it is often called the Black-tailed Deer, because the tail does not show as much white as does that of its relative the White-tailed Deer. The Mule Deer runs with a high bounding gait, quite different from the

flight of the White-tailed Deer. Its habits otherwise are quite like those of other deer. It is found from the Dakotas westward to eastern British Columbia and the Pacific Coast states, and as far north as Manitoba.

Like the other exhibits in the Hall of North American Mammals, the Mule Deer group represents a scene that has outstanding beauty as well as scientific and historical significance. In the background is the Devil's Tower, a spectacular shaft of columnar granitic rock that rises more than 1000 feet above the plains of northeastern Wyoming. Travelers who view this unusual geologic feature generally have difficulty believing that a human being could have ever scaled its cliffs. Yet the Devil's Tower has been climbed more than once, and it not long ago became prominent in the news when a man who had parachuted was marooned on top. The history of the Tower and the geological story of how it came into being were told in the November, 1942, issue of *NATURAL HISTORY*.

The impressive exhibit from which this full-color photograph was reproduced was made possible through the generosity of Colonel and Mrs. Richard K. Mellon. It provides an added inducement for anyone contemplating a visit to the superb assemblage of wildlife displays that have made the American Museum's Hall of North American Mammals famous.



February **NATURAL HISTORY** 1944

Dinosaur Tracks • Beaver Conservation • Winter Birds

Strategic Woods • Passenger Pigeon • Pet Mongooses

Continued on page 96

"Mon, 'tis e'er
a bonny d-r-rink!"

The consistent excellence of Teacher's
Scotch brings high praise from all
who know it. All agree that . . .

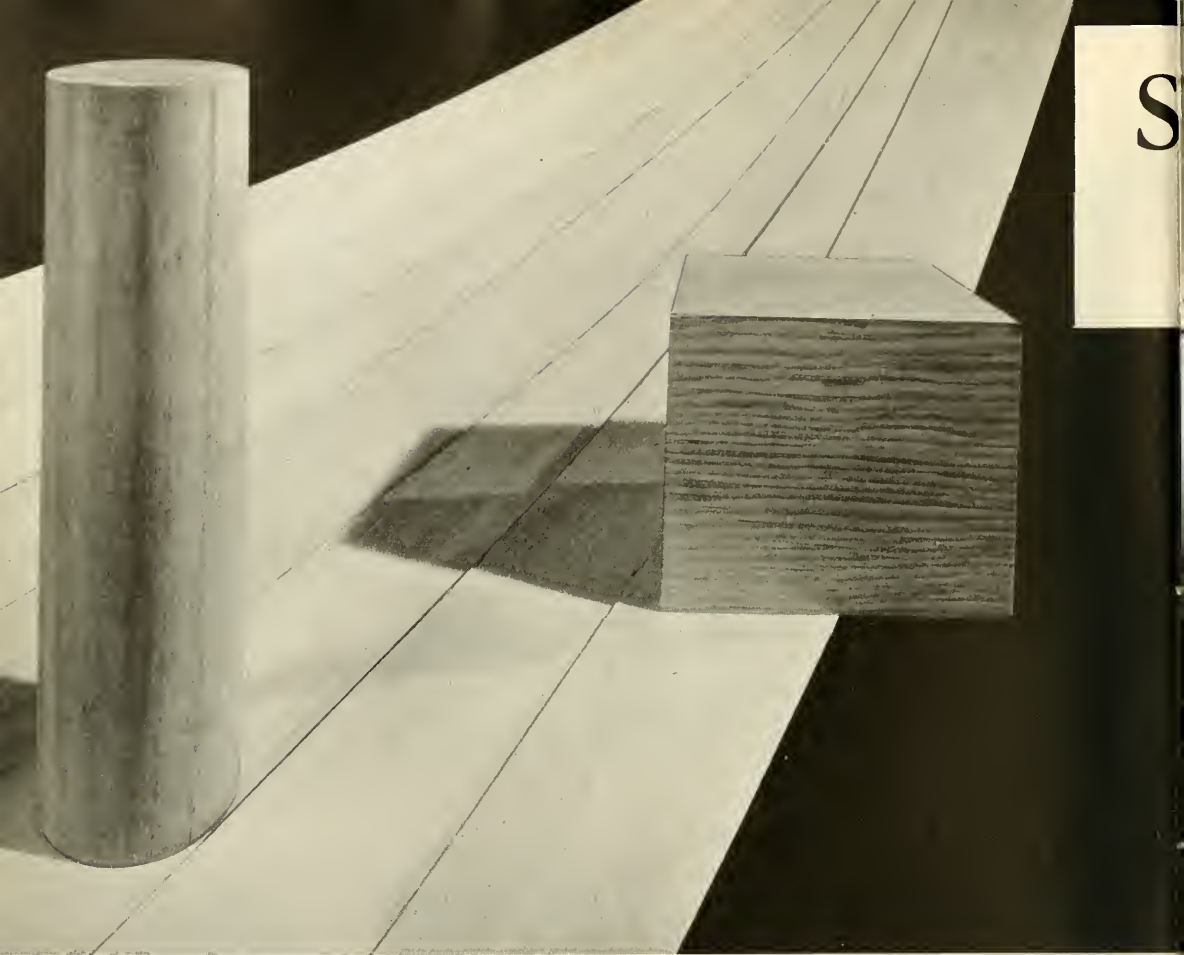
'It's the flavour'

96 PROOF

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By HAROLD N. MOLDENKE*

The sixth in a series of articles on products of the plant world that are playing a critical part in the war effort

A WRITER has recently pointed out that "the story of wood, in broad outline, is the story of the war effort." The military and civilian value of wood in the war effort is enormous. "From the battleship with its 300,000 feet of wood decking to the packing-case filled with tubes of vaccine, the Army and Navy list some 1200 items made from wood." In 1942 approximately 43 billion feet of lumber were used in the United States, of which the Government alone used 18 billion. The tonnage of wood products used in war

service in that year exceeded the tonnage of steel.

Forty-five per cent more lumber was cut in 1942 than in 1939. The construction of war plants and houses for war workers requires vast amounts of lumber. It is asserted that the Navy now has more uses for wood than ever before in its history. Every large ship has its staff of carpenters and its wood-working shop. Many naval vessels of combat caliber are actually made of wood, such as, for instance, the Motor Torpedo Boat Squadron commanded by Lieutenant Bulkeley in the Philippines—the squadron that helped General MacArthur escape to Australia. These boats are made of plywood.

Army and Navy crash boats used for rescuing airmen who have crashed into the sea are constructed of wood. So are the long, low-slung, fast submarine chasers, mine-sweepers, Coast Guard patrol boats, landing boats, whaleboats, pontoons, and barges. Large battleships and cruisers made of metal often return to home ports with gaping bomb-holes plugged with wood. Wood plays a very important part in the construction of the vast fleet of cargo ships being built for the heroic Merchant Marine, as it does also in cradles and ways at ship-building plants and dry docks at repair bases.

Both the Army and Navy have tremendous base establishments on land, including barracks, mess-halls, warehouses, hospitals, fire stations, field offices, recreation halls, bakeries, laundries, and temporary or permanent bridges. Wood is especially valuable in the construction of buildings

*The author is grateful to *American Lumbermen* and to J. H. Pierce in the *Journal of the New York Botanical Garden* for some of the information contained in this article.

STRATEGIC WOODS

of a temporary nature at high speed, since such structures may be built in sections behind the fronts, transported to the desired locations, and erected in a few hours. Recently the Navy has developed the production of laminated units, such as ribs and keels. Experts assert that this field of glued units is the most important in the entire field of wood technology today, rivaled only by wood chemistry. These units are built up by gluing several layers of thin wood upon one another with the grain running in the same direction. They are stronger than a single piece of wood of the same size or weight and are stronger than an equal weight of steel! The production of high-grade articles largely from low-grade material is rendered possible by this process.

Airplanes in the last war were constructed mostly of spruce wood, but wood was largely abandoned after the

war in favor of metal. At present the Air Force is again returning to wood construction, at least for certain types of planes. This reversal is due not only to the scarcity of strategic light metals, but also to the greater strength, lower fatigue ratio, and greater possible exterior smoothness of plywood. The bombing of Berlin is being done in part by wooden planes, Mosquito Bombers. Among other famous planes of this war made largely of wood are the American Caravan, Morrow Victory Trainer, Vulture Basic Trainer, and Curtiss-Wright transport planes. Propellers are in many cases made of wood, and the extensive decks of aircraft carriers are most often wooden.

Army truck bodies are now being made from lumber, thus saving great quantities of steel, reducing the weight of the machines, and adding to their strength and adaptability. Military

equipment of all descriptions—ranging from clothing, food, and medical supplies to bombs, machine guns, trucks, motors, planes, bulldozers, small arms, and thousands of other items—must be securely boxed and crated in wood for safe shipment to the Army wherever needed. Charcoal made from wood is employed almost exclusively for polishing the lenses of optical instruments, as well as for certain types of projectile firing, for land mines, and signaling. Charcoal is also an essential ingredient in the manufacture of gas masks and is being used in ever-increasing quantities as fuel for motor trucks. It is said to be quite dependable and will provide as much power as the motor and chassis are capable of standing. In Russia fuel gas is developed from wood chips, and by the end of 1942 there were some 100,000 wood-burning autos and trucks in that country.

A well-known principle of optics is that an uneven surface will not reflect light as well as a smooth one. Acting on this principle, the Army is using enormous quantities of sawdust and planer chips as camouflage. The material is dyed an appropriate color, mixed with an adhesive, and blown on the buildings or equipment which it is desired to obscure. Roadways are covered with it to render them less conspicuous from the air. On the home front sawdust is being pressed into briquettes for use as fuel. It is used for making wallboards and is mixed with planer chips for building blocks. Possibly it may soon be used for paving streets.

Ethyl alcohol, used in making explosives and rubber and hitherto secured from farm crops such as corn and sugar cane, can be derived from wood waste instead. In the process of making it from wood waste, a by-product is lignin, which has possibilities in the manufacture of plastics and fertilizers. Sawdust of sugar maple wood is now used in cleaning furs. Waterpipes are once more being made of wood, even in sizes up to 16 feet in diameter, and they may perhaps be made even larger. Bomb shelters which can be erected very quickly without the use of nails are being made of heavy timbers of tongue-and-groove design. It has been stated that from 1940 to 1942, 435,000 tons of structural steel were saved by wooden construction of a newly perfected system which gives more than ordinary strength. Wood is

▼ RAFTS of the lightest known commercial wood: balsa ready for the sawmill at Guayaquil, Ecuador. Balsa is extremely important for life belts and light weight plywood parts in airplane construction. Thousands of board feet are turned out daily in this one city. It weighs only half as much as cork, but a veneered wing-brace of balsa weighing 1½ pounds will support 750 pounds at the center of a 5-foot span

USDA—Foreign Agricultural Relations photo



being widely substituted for metal and plastic articles—witness, on the home front, wooden handbag tops, wooden flashlight cases, and wooden buttons. It is even being used as a substitute in cosmetics, and now garden hose connections are being fashioned from it. A new plastic is being made from California redwood in the manufacture of steering-wheels on trucks, buses, tractors, and other mobile equipment.

Probably ranking first in importance among strategic woods is balsa (*Ochroma lagopus*). This feather-weight wood is used in large quantities in plane construction. Carefully waterproofed, it is made into life rafts, mine floats, and life preservers. During the last war 80,000 balsa floats were used to support the 250-mile submarine mine barrier in the North Sea. So vital is balsa to winning the war that the Combined Raw Materials Board, set up by the United Nations to keep war plants here and abroad supplied with essential materials, has requisitioned every ounce



of the wood and allocated it to war factories. Lives of thousands of merchant seamen have been saved by balsa life floats. In 1942 we imported about 15,000,000 board feet.

Balsa grows wild from southern Mexico and the West Indies south to Bolivia. Search for new stands of this precious timber goes on in unexplored regions throughout this vast area. Ecuador has been the principal source of the wood, producing some 98 per cent of the world's supply, and the annual production has now been boosted by some 2,000,000 board feet. The city of Guayaquil has 10 concerns engaged exclusively in processing balsa, and these have been given high priority rating for obtaining new sawmill equipment. Some 2,000 men are employed in these mills, and thousands of board feet of processed balsa are turned out daily.

Balsa is the lightest known commercial wood. It does not hold nails or screws under strain, but it takes glue remarkably well. Mature trees

are 60 to 90 feet tall, with very striking, beautifully mottled white and gray bark. The leaves forming the huge crown are each a foot or more long and about equally wide. It is typically a "weed tree," growing rapidly and often in continuous colonies on cut-over or abandoned land. It is particularly fond of moist lowlands. In dense jungles one seldom finds more than 2 or 3 trees per acre. Its light wood was employed by the ancient Incas for making rafts. The first Spaniards to see these rafts applied the name *balsa*, which is Spanish for



"raft."* Gradually this word was applied to the tree itself. Its wood is only half as heavy as cork. Best grades weigh only 7 pounds per cubic foot; cork weighs 13. Once used extensively for making toy airplanes and other toys, it is now saving lives at sea and carrying cargoes of weapons to the fighting fronts.

Best quality balsa wood comes from trees about 6 years old. If the trunk is accidentally injured during its growth or if the trees are too old, the wood then formed is heavier. Because of their sap-filled cells, green balsa logs are quite heavy—in fact, so heavy that oxen are required to drag the 10- to 18-foot logs. If left on the ground more than a few days the soft spongy wood deteriorates rapidly. The logs are therefore dragged to a river's edge soon after felling. There the bark is removed, and they are then tied together in rafts up to 150 feet long. The wood is so spongy that very sharp tools are required for cutting it into boards. The boards are air- or kiln-dried to drive out their water content. The dried wood is famous for its lightness, buoyancy, and nonconduction of heat and vibrations. The reason for this is seen in the microscopic structure of the wood. Its individual cells are hollow and barrel-shaped, and they have extremely thin walls. They closely resemble the cells of pith or bark of temperate-zone woody plants or those of a vegetable like a

* Balsa on Lake Titicaca, Bolivia, are made of bulrushes, in the Philippines of bamboo.

turnip. Balsa may be bent sidewise or compressed from the ends twice as easily as spruce (which has 4 to 5 times its density). A 3-inch cube may be compressed to ½ inch under 10,000 pounds of pressure and comes



back to 2 inches when the load is removed.

To provide greater strength, balsa wood is often combined in "sandwich" construction with other woods in aircraft production. Wing-braces of balsa, veneered with fiberboard, weigh about 1½ pounds and will support 750 pounds in the center of a 5-foot span. Such balsa plywood is used extensively in glider construction, in pontoons for hydroplanes, and for streamlining struts and braces. Lifeboats by the thousands are being constructed of it. In the U.S.S. *Manhattan* a gross weight of 150,000 pounds was saved by the use of balsa cores in the cabin partitions. Because of its insulating properties, the holds of ships and refrigerator linings are made of balsa. Boxes for holding perishable commodities at a specified temperature during shipment are insulated with it, as are trucks carrying perishable foods to troops. Because it absorbs vibrations, it is employed for ceilings and wall partitions to absorb sound waves; and under heavy machinery it checks the transmission of vibrations to other parts of a building.

Unexpectedly large quantities of balsa are being produced from stands on abandoned banana plantations and other clearings in Guatemala. In Ecuador, commercial planting was begun in 1918, by the United Fruit Company. Another large plantation was started in 1927. In 1941, 10,000 seeds were planted on one plantation. The two-year-old trees are now 30 feet tall and 5 to 8 inches in diameter at the butt. In 1943, 100,000 more seeds were planted. Balsa programs are now also under way in Costa Rica, Nicaragua, and Colombia. Costa Rica produced about 4,000,000 board feet last year.

There are several other woods as

➤ MIGHTY CORK OAKS from little acorns grow: a branch of a tree that has been of strategic importance since the outset of the war. Native to uplands in Spain, Portugal, and northwest Africa, the cork oak provides a material that is vital in the construction of airplanes, motors, insulating board, and scores of other items of equipment for war. An automobile alone uses cork in 50 different places



Boury, from Three Lions



Ewing Galloway photo

◀ REMOVAL OF CORK from a tree in Southwestern France. Cork is not harvested until the tree is 15 to 20 years old. If care is taken not to bruise the cortex, the bark will grow again in 9 or 10 years. The average life of the tree is 100 years



Ewing Galloway photo

➤ A LOAD OF CORK being hauled through the streets of Seville in a typical Spanish cart with the mules hitched in tandem

light or almost as light as balsa, such as the *big-bellied tree* (*Pachira barrigon*), *quipo* (*Cavanillesia platani-folia*), *corkwood* (*Leitneria floridana*), and the Guatemalan *batz*, *cajeto*, *corcho*, *bache*, and *mecate*. Most of these either lack the strength of balsa or have not been found in sufficient quantities to warrant their commercial exploitation. In an emergency they could, of course, be used.

Of almost equally vital importance is mahogany. The famous PT boats—those 70-mile-an-hour miniature destroyers which wrought such havoc in Japan and the Philippines—are made largely of mahogany. Before the war the United States imported most of the so-called mahogany from Africa and the Philippines. Mahogany for future fleets of speedboats, as well as for home and hotel furniture, may soon come from cultivated forests of the African (*Khaya ivorensis*) or Rhodesian mahogany (*K. nyasica*) grown in Florida. Trees planted experimentally in that State are catching up in height with fast-growing native pines twice their age. They have trunks twice the diameter of pines as old as themselves, and are forming wood four or five times as fast.

Because of transportation difficulties due to the war, African mahogany has now largely been replaced by American mahogany (*Swietenia macrophylla*) from Mexico, British Honduras, Guatemala, Nicaragua, Brazil, and Peru. All imports of this wood are now restricted to military and naval use. Large quantities of this excellent wood are being used for plywood veneers and parts for airplanes,



boats, and ships. Marine architects have long preferred it to almost any other type of wood. It is used extensively to make patterns and models needed in the manufacture of war products and for cases to protect valuable scientific instruments. In 1938 the United States imported some 50 or 60 million board feet of "Philippine mahogany" in lumber and logs. It was then used for highly figured wood in furniture and other products



Burton Holmes photograph, from Ewing Galloway

▲ STACKS OF CORK ready for shipment, near Algeiras, Spain

for civilian use. Now this straight-grained, strong, tough, and well-woven wood is used for planking on the hulls of PT boats and as a veneer for fighting planes. Fifteen million board feet are coming from Mexico this year and 6,600,000 from Peru and Brazil. Tractors, logging-wagons, trailers, power-saws, and even an entire West Virginia sawmill have been shipped to Nicaragua to facilitate production there!

Everyone is familiar with cork. It is produced by the evergreen cork oak (*Quercus suber*), native to the uplands of the Mediterranean regions, Iberian Peninsula, and northwest Africa. In all of this area there are probably about 6,000,000 acres of cork oak. The United States normally uses about 40 per cent of the total production, or about \$10,000,000 worth annually. Formerly it was extensively employed for stoppers, floats, insulation, linoleum, gaskets, table mats, pin cushions, children's toys, etc. Now the Army and Navy list cork as one of their major critical materials. Machines ranging from vacuum cleaners to airplanes use cork somewhere in their construction. Cork gaskets and washers are necessary to keep grease and oil at work. It is used in 50 places in an automobile. There are a few thousand mature cork oaks growing in the United States, on plantations

in California, Arizona, and New Mexico. But it is estimated that all the cork oaks in the country could not furnish more than one per cent of the supply needed annually. The *pau santo* (*Kielmeyera coriacea*) of southern Brazil is being considered as a substitute for ground cork. It is one of the most abundant trees in the forests of south-central Brazil, and some 8,000 tons of cork are produced from it per year. The skins of potatoes are also being used. Several native trees produce a kind of ground cork suitable for heat insulation and packing material. These include the southwestern fir (*Abies arizonica*), a variety of douglas fir (*Pseudotsuga taxifolia* var. *suberosa*), and the white fir (*Abies concolor*). An industrially practicable process has been patented for extracting the cork from douglas fir and refining it chemically to produce a material suitable for bottle-cap liners, linoleum, and insulating board. Bulrushes (*Scirpus lacustris*, *Cyperus papyrus*) are being used in the Old World as a new source of pressed wallboard, said to be better than cork for insulation inside of tanks.

Acorns of cork oak have been shipped from Spain and Portugal, and more than 60,000 vigorous young cork oaks have been planted in America since 1940. An additional 150,000

seedlings are now ready for planting. A cork oak in California recently stripped for the first time yielded 151 pounds of ground cork. A domestic cork-growing project is under way to make the nation eventually self-sufficient in this essential war material. A program for annual planting has been set up in all states where the climate is suitable. Cork is not harvested until the tree is 15 to 20 years old. In 9 or 10 years the same tree will yield



another crop. The average life of the tree is 100 years.

The great forests of the Americas are being explored for woods of all kinds. Charcoal, a common fuel in all tropical countries, has been the only domestic fuel used in Venezuela for many years—1200 trees a day must be cut to supply the city of Caracas

alone. The heavy wood known as *cocobolo* (*Dalbergia retusa*) from Central America has long been used for the handles of kitchen knives. An urgent use of lignum-vitae (*Guaiacum guatemalense*) is in self-lubricating bearings of propeller shafts. Like many other tropical woods, lignum-vitae is so heavy that it sinks in water. *Roble*, from Ecuador, is a possible substitute for the teak needed in the decks of aircraft carriers and other vessels. Chemical paper pulp has been made successfully from *Paraná pine* (*Araucaria angustifolia*), native to southern Brazil.

Wood was literally the backbone of early America. It provided the beams and rafters of its homes, the strength of its ships, the cheer of its hearth-fires. Though steel, aluminum, and rubber are reputedly the most critical war materials, we send more tons of wood to war than we do steel. This past year our Army camps alone used more than two billion feet of lumber, hauled to the building sites in 80,000 wooden freight cars. From our forests come decking for battleships, aircraft carriers, mine sweepers, patrol boats. Pulpwood is used for making smoke-

less powder, rayon for parachutes, plastics for aircraft parts, paper, shell-casings, hospital waddings, and containers for blood plasma, food, and munitions. Research into lignin is



opening up new vistas, creating new businesses and changing old ones. Lignin was once just a waste product in paper-pulp manufacture. Now it is used as a binding material for road surfacing, in paste for laying linoleum, as a tanning agent, a base for dyes, a source of synthetic vanilla, and as a plastic in durable hardware that equals metal in strength! This may be an Age of Steel and Electricity, but *wood* is still a strategic necessity!

Next month: strategic vegetable drugs.

SAVE PAPER AND YOU SAVE WOOD

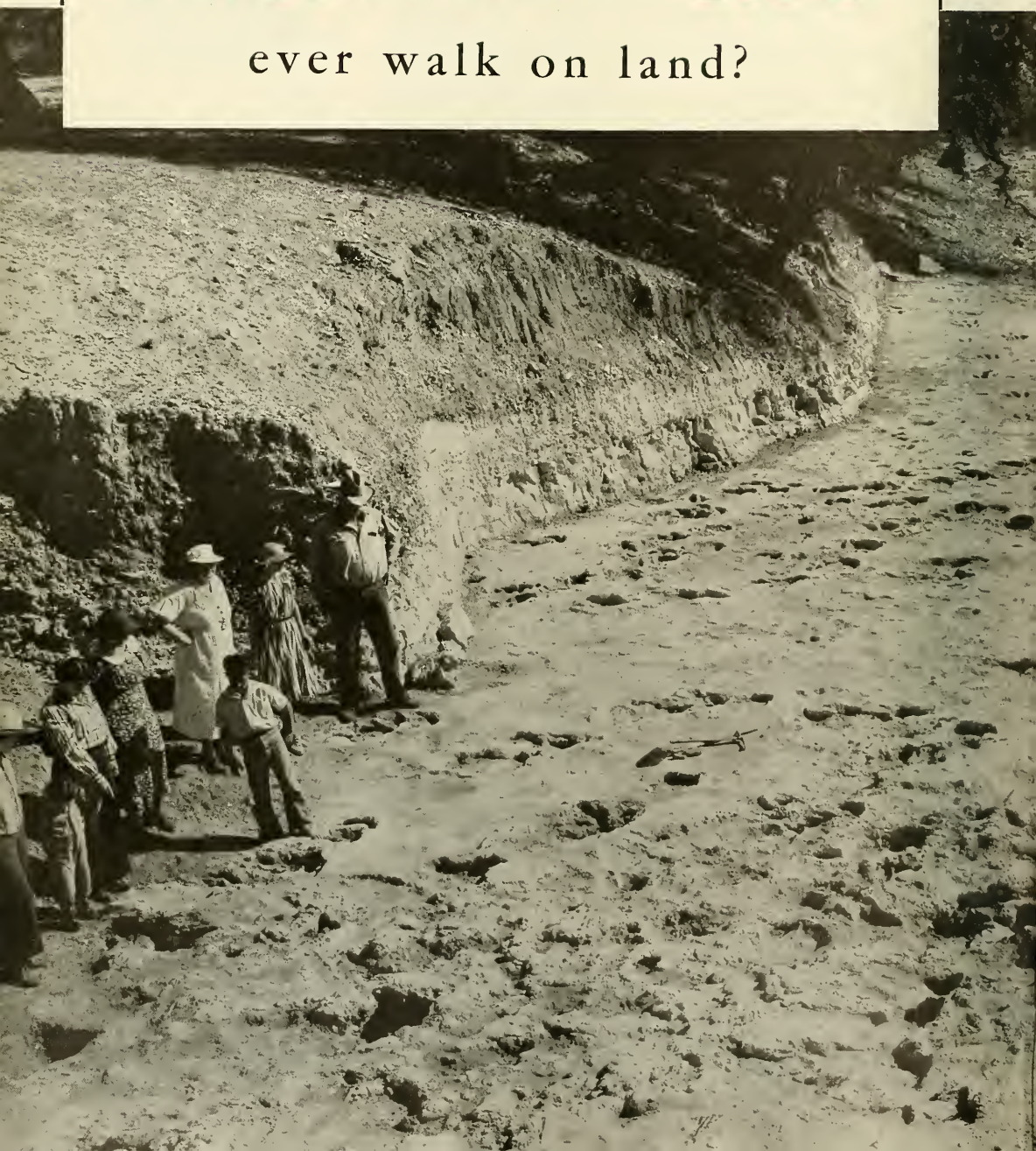
▼ A LARGE CORK OAK growing near Daphne, Georgia. All the mature cork oaks in the United States could not produce more than one per cent of

the country's needs. More than 60,000 young cork oaks have been planted since 1940, and an additional 150,000 seedlings are now ready for planting

Photo by George N. Lamb, courtesy U. S. Forest Service



Did
BRONTOSAURUS
ever walk on land?





Spectacular footprints
help to solve a mystery
of 120 million years ago

By ROLAND T. BIRD

*Department of Geology and Mineralogy,
The American Museum of Natural History*

◀ **WHETHER THE LARGEST** of all dinosaurs had legs capable of supporting their enormous weight on dry land has been debated for some time. A full-size *Brontosaurus*, or "Thunder Lizard," was about 70 feet long and weighed as much as four or five six-ton elephants. Perhaps no better answer to the question of whether they were creatures of the land or water will ever be found than is given in the footprints on the Davenport Ranch in Bandera County, Texas. The tracks at first appear as a muddled hodgepodge on this cleared ledge along West Verde Creek, as shown at left. The story they tell, however, together with that of another find in Bandera County, throws even more light on the habits of these dinosaurs than the trails described from near Glen Rose, Texas, in the February, 1941, issue of *NATURAL HISTORY* ("A Dinosaur Walks into the Museum")



▲ How do dinosaur footprints look that have been seen hundreds of times but never recognized by passers-by? The writer, highly elated at first glance at this rare sight, snapped the camera while Smoky Davenport was pointing to several forefoot impressions visible among the leaves and other riverwash. Several three-toed prints of a carnivorous dinosaur also visible on the ledge had been known for some time

▼ LOOKING for the answer to another question that frequently faces the finder of dinosaur footprints: what lies under the bank where the trail leads? Stripping away the overburden to uncover the track-bearing layer was almost as thrilling as digging for buried treasure. The trail of the three-toed carnivorous dinosaur is visible over the heads of the men at left. This undertaking, sponsored by Dr. E. H. Sellards of the University of Texas and by the American Museum, was carried out in 1940 by the Texas State-Wide Paleontological Survey, under the direction of the author



▼ A SIZEABLE PORTION of the overlying ledge has been removed, and the men are now cleaning away the soft material that filled the footprints as mud and hardened to form shale. Biggest surprise was the number of trails encountered. Partially disappointing was the lack of iso-



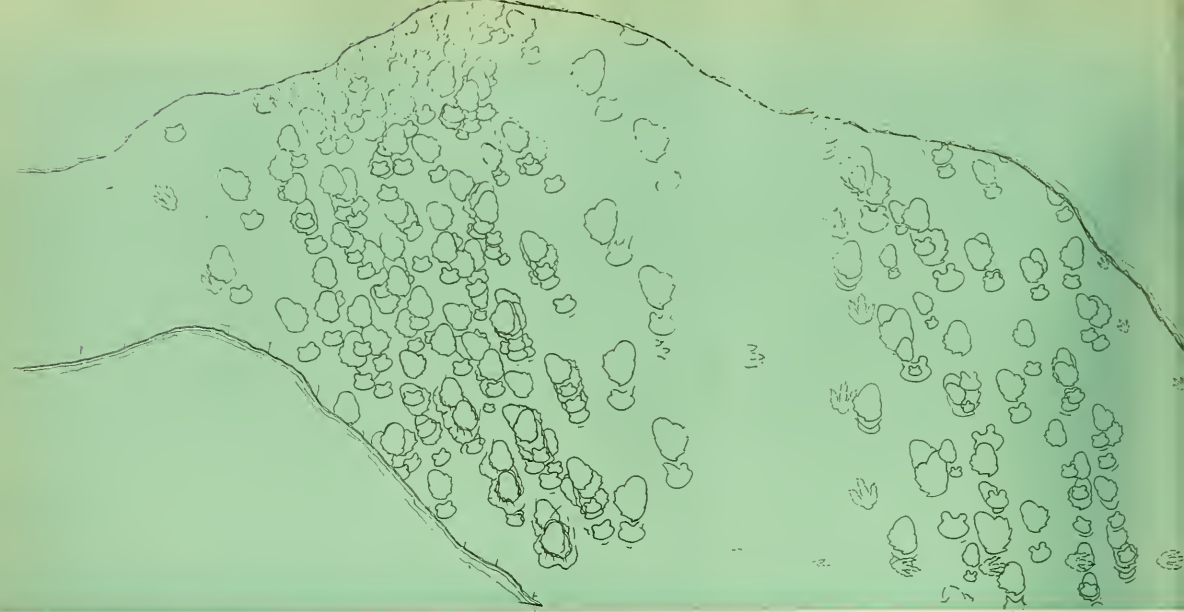
lated trails suitable for removal for exhibition purposes. The ancient mud flat which had been covered by succeeding layers of sediment had hardened into rock. Upon being exposed again it was found to retain every mark made on it approximately 120 million years ago



▲ LOOKING OVER A CORNER of the landscape that hadn't been touched by the light of day since the time of the dinosaurs. Immediately behind the writer is a remnant of the massive deposits that covered the area after the footprints in the foreground were made. Sun cracks in the silt filling the footprints indicated that the surface had sometimes been above water

▼ THE SAME AREA from above. Careful study revealed the trails of seven sauropod dinosaurs (leading away from the camera). The purpose of the partly visible strings stretched in two directions was to aid the chart-maker. Only after all the tracks were mapped could much be told about the creatures that made them. Each square is one yard





◀ TRAIL NO. 8 was the only sauropod trail in the quarry that did not cross another. It shows three strides of the left front and back feet, four strides of the opposing rights. The big dinosaur seemed to be moving at a leisurely rate, occasionally dragging a foot before picking it up. In the background, 15 more sauropods wandered, like cows going down a country lane

▼ SKETCH OF THE PASSING HERD, showing the surprising conclusions the trails suggest in relation to a sauropod's ability to walk on land. If the smallest animals in the herd were wading, as the depth of their tracks indicates, then, by comparison, the larger creatures were progressing well out of water.



◀ THE ALL-IMPORTANT CHART of the dinosaurs' "stamping ground," partly compiled on the spot but not completed until after considerable study of the evidence. It greatly clarifies what took place and how the great animals appeared when the trails were made. Of the 23 individuals crossing the area, all were headed toward a common objective. This

suggests that they passed in a single herd, an important conclusion, borne out by the consistency of the preserved tracks. Some of the three-toed prints, representing carnivorous dinosaurs, were made before the sauropods arrived, others later. This indicates that the mud flat was often nearly bare of water and close to a shore line



► PERHAPS one of the most amazing collections of tracks ever uncovered: a close-up of the background of the preceding photograph. Here a "parade" of dinosaurs converged, stepping repeatedly in the same tracks until they resembled craters in the mud. But every slip and slide is perfectly preserved, including great curls of displaced mud, as seen at lower right. Even occasional lumps falling from the feet of the dinosaurs remained loose upon the surface



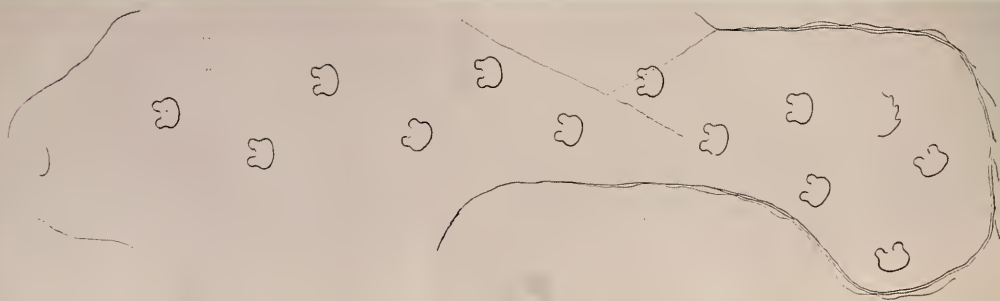
The question, "Could Brontosaurus walk on land?" can be answered in all probability in the affirmative. However, the water level in this instance seems to have been high enough to float the tail of each individual free of the mud flat; otherwise tail tracks might have been left





◀ HOW WOULD THE TRAIL of a floating sauropod appear? This single trail seems to answer that question. It was found on the Mayan Ranch, also in Bandera County. From a hasty examination it might appear that the dinosaur, moving toward the camera, was walking on its front feet. But further excavation revealed the print of a hind foot (*at lower right*) where the animal had kicked out in making a turn. The explanation is that the dinosaur was swimming, partly propelling itself forward by kicking the bottom, steadily with the forefeet, occasionally with the hind. The drawing above illustrates this. It can probably be assumed, therefore, that these 30-ton creatures were excellent swimmers. And while they do not seem to have lost the ability to walk, they may well have preferred to stay in water that was not too shallow and thus take advantage of its buoyancy

▼ IN THIS CHART of the trail just discussed, the forefoot tracks are 23 inches across. The length of the strides is about eight feet. Note again the partial hindfoot impression, made when the enormous reptile sought to alter its course sharply to the right



▼ ARE THE FOOTPRINTS below also those of a swimming sauropod? They were first reported by John McClary of Pueblo, Colorado, and are in the exposed bed of the Purgatory River. The puzzling feature was that they could not have been the trail of any known two-footed dinosaur, nor that of any quadruped moving along on all fours. However, it seems reasonable to believe that, although they are somewhat different from the Mayan Ranch tracks, they were made in the same manner by a related type of dinosaur. More than one individual is represented, for another trail crosses just beyond the foreground



▲ WAS THIS GROOVE made by a dragging tail? The dinosaur tracks adjacent to it are poorly preserved; and at first the furrow was thought to have been worn by a creek. But more careful examination proved it to be part of the original mud surface. Can you visualize the big tail that seems to have made it—a huge dinosaur walking over the mud without even enough water to float his tail? This trail is to be seen not far from the large group of tracks at the Davenport Quarry on West Verde Creek, Texas



► ONE OF THE BIG TRAILS uncovered along the Paluxy River near Glen Rose, Texas, in rocks of the same age as the Davenport Ranch tracks. One can almost see the big creature as he labors through the mud and turns, perhaps toward deeper water. Note the trail of the three-toed, flesh-eating dinosaur following along just to the left of the larger tracks. Was the flesh-eater merely following the big sauropod's path across an area where the water was not too deep for him to wade, or was he in actual pursuit of the monster? The answer is anybody's guess. The territory of these two distinctly different types of dinosaurs overlapped along this ancient water front, as in Bandera County



The stirring story of the restoration of Colorado's threatened beaver population shows that some of the benefits of conservation may be unexpected

LAST YEAR 12,240 beaver pelts left Colorado's mountains journeying toward fighting fronts. Many will line warm garments for airmen and arctic troops. In Colorado the beaver is staging a comeback that would make the shades of Kit Carson, Jim Bridger, and their Fur Brigades stand in amazement. This is no outdoor miracle. It is the result of a real conservation program in militant action.

There is no clear historical record of how many beaver pelts were taken long ago from the streams that now lie within Colorado. On July 1, 1825, William Henry Ashley held the first great trappers' fair not far from where Utah, Wyoming, and Colorado have a common point on their boundaries. Several hundred Indians and 120 white trappers gathered there to trade, gamble, get drunk, fight, and race horses. In two days, Ashley had traded

for upwards of \$40,000 worth of skins and then returned to Saint Louis. That represents many bundles of fur, but it was the harvest from the entire region.

That began the heyday of beaver trapping in the Rockies. For sixteen years trappers sold furs at these rendezvous. Then the price of pelts sagged, and the old fur brigades left the scene with many a stream totally stripped of beavers.

As states were established, laws protecting beaver were enacted, but in Colorado the beaver population dwindled until in 1920 an active

beaver colony was a rarity. They were near to extinction. Then slowly they began to increase.

Impetus was given to organized management of the beaver resource in May, 1937, when direction of Colorado wildlife administration was placed in the hands of a six-man commission. At its first meeting the Commission passed a resolution establishing a State Trapper Service primarily for the purpose of removing beavers from spots where they were a nuisance.

Prior to that time Colorado, like most western states, had what was known as the "permit system." A rancher who suffered from beavers working on his place could secure a permit to trap ten animals. There was little chance to keep track of how many he took on his permit. So long as he had only ten hides in possession at one time he was comparatively safe from legal proceedings. Often pelts



THE RETURN Fur

Courtesy of New York Herald Tribune; Rice photo

▲ **NATURE'S FOREMOST ENGINEER** makes the land more valuable. The dams he constructs in mountain streams save the farmer's fields from flood and drought and prevent his irrigation ditches from silting up. Beaver ponds attract fish, birds, and other wildlife. The beavers shown above were photographed at the Palisades Interstate Park at Bear Mountain, New York, where thousands of visitors each year observe their industrious and ingenious ways

➤ **A BEAVER DAM** of aspen trees in Estes Park, Colorado. A chain of such dams, each presided over by its family of "resident engineers," breaks the force of spring freshets and lessens destructive erosion. The Colorado conservation system provides for the distribution of beavers to water courses needing them and their removal from lands where they have become so numerous as to be a nuisance

were taken by the score, the excess hides going into the hands of "hot beaver" operators. Illegal fur rings sprang up throughout the West. Boot-legging beaver was a profitable racket. It still is in some localities where the permit system persists.

The next step toward setting up the present program in Colorado was taken in 1941, when the State Legislature passed a fur law. A Fur Resources division of the Game and Fish Department was established, and the law provided that it was the only agency that could take beaver pelts legally. If a rancher has beavers damming his irrigation ditches, he now notifies a State Fur Inspector. A trapper is dispatched to the trouble spot, the beavers are removed, and the pelts are marketed by the State. The landowner receives half the price secured for the pelts. Where beavers are trapped on public lands, all proceeds go to the Game Cash Fund to further underwrite the program. The program thus finances itself.

There is no intent that the Colorado beaver restoration program shall make large profits. So far the State's share of receipts has little more than met the costs of operation. The State's

part of the gross income must pay for removing all "trouble" beaver, and sometimes the cost per animal is high. A commercial trapper merely would take the easily caught pelts, leave some animals for "seed," and move on. A State trapper cleans out all trouble beaver from an irrigation system.

This control of nuisance is a first objective of the program. That is a responsibility definitely established in the Fur Law.

The second objective is a dynamic illustration of the new interpretation of wildlife conservation and use. It is a broad, inclusive, long-visioned program, designed not only to increase the fur values in the state, but to secure all possible benefits arising from intelligent handling of the beaver resource.

If beavers with prime furs are caught, their pelts are sold. But thousands taken when fur was not prime have been moved from ranches to headwater streams in the mountains. The main goal of the Colorado beaver program is to build up the beaver populations in high mountain areas until every good beaver stream is stocked.

Beaver dams in high basins catch and hold back snow water as drifts

melt in the spring. Earth around beaver ponds becomes saturated, forming ground reservoirs. The water table in mountain meadows is raised; the grasses are subirrigated and grow lush. The ponds and the saturated meadows later feed water to streams below, and late summer water for irrigation is more precious than water during the abundant spring run-off. The Water Commissioner of one western Colorado district reports that since beavers have built their ponds on headwater streams of that district, the flow of water in August has doubled.

Slashing showers whipping the high, steep slopes of the Rockies may start a flash flood rolling down toward farms in lower country. Many western fields have been washed and covered with gravel, mud, and boulders by such floods rushing down unobstructed channels. But beaver ponds—in some valleys scores and even hundreds—spread the flood crest out thin, dissipate its force, impede its flow at the crest of each dam, and break the power of the freshet. Few floods, starting in angry headlong runs from above timberline, can pass through the entanglements of a series of beaver dams without being tamed.

Beaver ponds trap silt. Every year thousands of dollars are spent in digging silt from irrigation ditches and reservoirs. If the silt is trapped in a beaver pond back in the hills, it never clogs irrigation installations in valleys below. In the Sangre de Cristo Mountains, there is an old dam which once held back nearly twelve acres of water surface. The dam is nine feet high. Silt filled the pond. The beavers moved on. Grass is growing on the rich, deep alluvial deposit. And this is only one of at least two dozen other old dams in that series that have been filled and are now becoming green meadows. Most of the mountain ranches of the West owe their existence to old beaver colonies that were building silt traps years before the first fur brigades raided the Rockies. Often a creek winding through a mountain meadow cuts an earthy bank and uncovers long-buried remains of old beaver workings.

In still another way, the Colorado beaver planting program has aided ranch operators. Near Hotchkiss, the stock water on one rancher's summer range was a tiny brook, so small that it dried up by late July. The stock had to be moved to better watered grasslands. Abundant feed remained, but no water for stock. Beavers were transplanted to this little stream. To-

RN OF THE Brigade

By ARTHUR HAWTHORNE
CARHART

Photo by Hugh S. Davis



day the beaver ponds have saturated the headwater area. All summer, springs feed into the little stream, and full utilization of the range is possible. This is no isolated case. The program has included the deliberate scouting of such sites for beaver planting.

These are some of the direct, economic values secured by the live beaver transplanting program. It is a basic policy to live-trap beaver in the low country and move them to the aspen grove belt in high mountain basins to secure these results. But another group of benefits is also secured—those affecting other wildlife.

The finest muskrat furs of the West come from the high country. Within a few months after a beaver pond is established, muskrats move in and live there without conflict with the beavers. Officials of the Colorado Raw Fur Dealers' Association have stated that

if no other good resulted from establishing beaver colonies in high basins, the increase in high quality muskrat skins would justify the effort.

Wild ducks have found marshy beaver ponds in mountain valleys. Many a pair have canceled their reservations in Manitoba and set up summer housekeeping on a Colorado beaver pond. While this is only a small addition to the vast nesting areas to the north, in the aggregate it is enough to accent further the worth of the beaver program.

Finally, a mountain beaver pond is a home for trout. In some eastern states, where temperatures are higher than in the Rockies and where streams flow more deliberately, beaver ponds sometimes have been detrimental to trout. The water temperatures climb too high under a summer sun and organic matter in the bottoms of the

pond rots, producing injurious gases. In the western mountains, the water running into beaver ponds often comes from snow-fed springs. It is cold and stays so. The downgrade is steep. There is scant chance for the water to stagnate in one pond before it splashes over a dam. There it is freshly aerated and cooled before entering the next pond. Western mountain beaver pools are good trout water.

With control of "nuisance beaver" first, these are the goals of the Colorado program. It is not a series of unrelated actions dictatable by immediate exigencies, but planned and long-range.

In 1942, more than 1500 beavers were live-trapped and moved from trouble areas to high basin locations. In preceding years, several thousand had been planted. They are seed stock of future fur supplies, and even while

Courtesy of New York Herald Tribune; Rice photo



they are increasing toward the point where harvest must commence, they will be achieving the other objectives of water and wildlife improvement.

This program has advanced to a point where fur brigades again are in the big hills. They are not clad in buckskin but in the field uniform of the Colorado Game and Fish Department. They frequently ride over old horse trails, but as often they drive a pickup truck along modern highways. Already the beaver population is built up in some watersheds to where it must have annual harvest to protect the beaver colony's food supply.

If a beaver hide is taken from private property under this state conservation program, it is given a serial number. The landowner gets half the gross price from hides removed from his property, and he gets half of the

income from specific hides, not from an average price of all pelts sold. It involves bookkeeping but it does not penalize a landowner who has had high value hides removed from his place, nor pay another more than the hides from his lands actually are worth.

It is uncertain how many beavers were in Colorado a few years ago. Today, by systematic checking, a conservative estimate places the state's beaver population at 50,000, and they are on the increase in spite of the present annual harvest. The live-trapping and transplanting is partly responsible for the increase, but another reason lies in outlawing the old "permit system" and in better enforcement against the "hot beaver" racket it fostered. The State now runs the beaver business for the benefit of the state and its people.

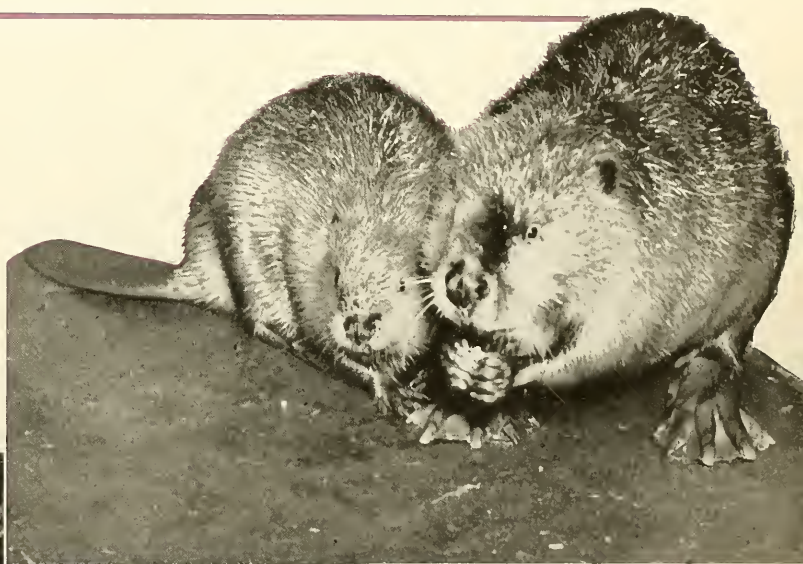
Today most of Colorado's beaver skins go directly to serve war needs. The fact that 12,240 pelts were available last year to meet these demands rests on the progressive development of the Colorado beaver program since the Game and Fish Commission set up its Trapper Service in 1937. In that short time it has proved what may be done in good game management based on sound conservation principles.

Tomorrow, when war has gone, many of the major objectives of water conservation and wildlife development that center around the beaver pond will have been achieved. In Colorado, the beaver is not on his way back; he is very near to full restoration. If anyone seeks a demonstration of the value of true conservation, he finds it in this pay-as-you-go beaver program in Colorado.

◀ **WOOD AND WATER** are the beaver's specialty. He lives on bark and makes his home safe from enemies by raising the water level high enough to cover the only doorway

▶ **THE BEAVER** has a versatile pair of "hands," and his webbed hind feet make him a strong and skillful swimmer. Note the broad, flat tail, whose resounding whack as it hits the water as a warning to other beavers is a familiar sound to many lovers of the outdoors

Photo by Hugh S. Davis



Courtesy of New York Herald Tribune; Rice photo

◀ **A 13-INCH COTTONWOOD** neatly felled by the chisel-like teeth of a beaver. The few trees that are lost by chopping and flooding are a small price to pay for the economic advantages of a well placed colony of beavers. Most of the mountain ranches of the West owe their existence to beaver dams which caused the rich river sediment to be deposited

▼ THE WONDER OF THE WINTER FOREST lies not alone in its glistening beauty, but also in the thrilling lives of its wild-folk, in the fortitude, endurance, and gay courage of its winged woodsmen. A scene in northwestern Montana

Winter



Woodsmen

By JOHN L. BLACKFORD

▼ CLARK'S NUTCRACKER: winter woodsman of the high altitudes, on the trunk of a Mountain Hemlock at the rim of Crater Lake, Oregon



► A MIDGET WOODSMAN who braves winter in the high Rockies: the Mountain Chickadee

Photo by Winton Weydemeyer

THE gray-white snow clouds have lifted. The woodlands are robed in silver. Sparkling in the frosty air, snow crystals drift lazily down. The sharp *skeee-ack* of a flicker pierces the silence. Here is a realm of magic. Yet how many of us never know the wonder of the Winter Forest!

Besides a lagging determination to keep fit, we possibly need a new interest to take us outdoors at this season. Yet of this need, no naturalist, whether amateur or professional, ever seems aware. He sees the world with different eyes, and seldom requires any reminder from his conscience to put tired muscles to work again.

Despite its deathlike silences and pervading chill, one finds in the white wilderness remarkable communities of wild folk. To learn the story of their defiance of its merciless frost is to know that in the life of each feathered or furred individual there is written a saga of the cold.



▲ HANDSOME MEMBER of the woodpecker clan. The red-shafted flicker is an individualist who combines wild fruit gathering with insect destroying activities. He has a taste not only for the wood ants housed in the trunk and stub but also for other species on the ground. As this food source fails in winter, he is partly migrant. Yet he keeps a hardy rearguard posted throughout the northland



Among all the creatures of the cold, one discovers there is no more fascinating clan than the valiant protectors of the ermine-clad forest itself—our winter woodsmen—the busy woodpeckers, creepers, nuthatches, kinglets, and chickadees.

Few ever realize the variety of the winter bird population or consider the extreme conditions in which these snow-time residents continue at work. Remaining with us are many aquatic feeders and fishers—golden-eyed ducks, mergansers, and kingfishers. Fruit and seed eaters, living upon Nature's stored bounty, are numerous—grosbeaks, cardinals, solitaires, and grouse. The northern hawks and owls harry

their prey to maintain a precarious existence, keeping the lives of all in peril as though winter's rigors were not sufficient risk. Following upon the others, resourceful scavengers such as ravens and jays barely keep bone and feather together through the long, icy months when Winter rules. The comradely caretakers of the trees are mainly insect-destroyers.

Snow blankets the ground. Deciduous leafage has vanished. It is the time of insect hibernation; many forms have left only tiny, cunningly-hidden eggs to renew their kind. Many mammals have secreted themselves securely; and many birds have flown south.

◀ **ROCKY MOUNTAIN CREEPER.** Still unknown to the majority of travelers in our winter woods, the creeper is, if anything, even more industrious than a woodpecker. He is one of the most interesting characters that challenge the cold, but our discovery of him is delayed by his drab dress and obscure habits. He spirals up the scaly, furrowed trunks of the dense evergreens and is one of the most inconspicuous "woodsmen" who troop with the rollicking chickadee bands

▼ **BLACK-CAPPED CHICKADEE:** an optimistic organizer of the cosmopolitan crowds of small feathered folk who patrol the lower woods. In their train may be found nuthatches, creepers, golden-crowned kinglets, hairy and downy woodpeckers, and on occasion, dignified flickers and clownish jays. Higher in the Rockies, frisky mountain chickadees sometimes recruit yellow-crowned three-toed woodpeckers to their roving companies

▼ **THE WHITE-HEADED WOODPECKER** upholds the hardy, snow-time traditions of his industrious clan in the great forests of California's Sierras and northwards below the gleaming peaks of the Cascades. Among the sugar, yellow, and Jeffry pines, gigantic sequoias, moss-hung white firs, incense cedars, and black oaks, his tow head and white-patched wings signal his presence in the mighty, white-trimmed forests





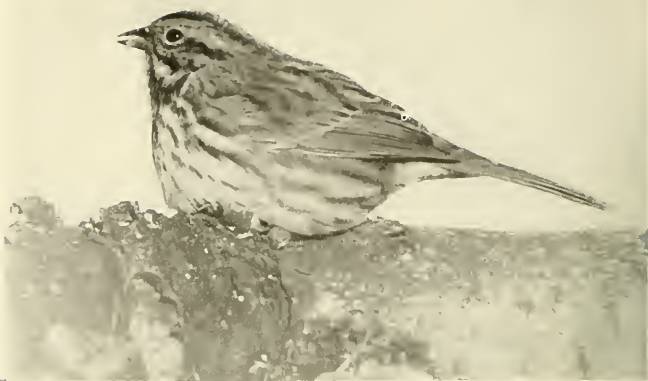
◀ **ACE INSPECTOR** of the bark and limbs, the white-breasted nuthatch keeps a year-round guard upon the health of our conifers and northern broadleaves. All the crevices and crannies where insect foes may lurk are minutely examined, and countless culprits are summarily dispatched. His fluted "yank, yank," coming distantly from mid-level in the frosty forest, frequently locates for us the chickadee patrol, of which he is a charter member



▲ **HITCHING** unconcerned along the underside of branches and head-first down rough bark avenues of the tree trunks, the midget red-breasted nuthatches demonstrate the thoroughness with which they perform their important tasks in the timber. In the yellow pine parks of the West their piping notes are echoed by the staccato cheeping of even more diminutive black-eared nuthatches—pygmy acrobats of the frost-whitened needle-clusters and small branchlets

◀ **DOWNY WOODPECKER** (subspecies Batchelder's downy). Smaller edition of the common black and white woodpecker that comes in two sizes throughout the country, the downy prefers the deciduous stream borders, mixed hardwoods and conifers, and your winter orchard. There he performs an expert job of tree surgery, ridding you of countless tree-killing pests. The hairy woodpecker is the larger model. He generally favors the denser snow-laden evergreens, as do the fascinating triple-toed American and Arctic woodpeckers and the noble pileated woodpecker

There is no opportunity, as in Summer, to increase during abundance; only the stern struggle to live amidst scarcity. Food must come from crevices and beneath the bark of tree and shrub; from swift waters that resist the cold; from fragile weed and grass stems above the snow; and from the bodies of wild things who lose the fight for survival. On this dramatic stage, among white-robed evergreens and bare broadleaves, those busy friends of the forest, our winter woodsmen, work and frolic. They are specialists in defying Winter in his own domain.



▼ **CRESTED JAY** (subspecies: black-headed jay). Wit, clown, and practical joker, the crested or Steller jay of the Rocky Mountains and Pacific slope is a boisterous, elegantly-clad camp follower of the chickadee-woodpecker woodland patrol. Raucous and archly silent by turns, he survives by his wits and his versatile appetite. Nuts, meat, and insects are his food; and he is also a thief, hoarder, and scavenger; yet who would not forgive the rascal? Such good looks and puckish humor are rare. His presence here in the crystal forest is proof of great courage beneath his colorful blue coat

▲ **SONG SPARROW** (subspecies: Merrill's song sparrow). Among the naked, leafless willows, shadberries, and birches of the stream sides a sweet singer of other seasons intrepidly "holds the fort" throughout the long months of hunger. Grass and weed seeds gleaned from bent stalks above the snow are added to insect fare garnered by the now secretive song sparrow, hiding mouselike amidst the shrubbery. He is one of the few that search the earth-floor itself through the bleak, snowy days of winter, under overhanging creek banks and root tangles where the white coverlet is never spread





The story of a camping trip
to an unusual Swedish island
in the Baltic

STORA KARLSÖ *Island of Birds*

By GRACE E. BARSTOW MURPHY

"WHAT has happened to Stora Karlsö in these war times?", I asked a gentleman in one of the many Swedish offices in Rockefeller Center.

With an expressive gesture, he answered, using a pleasant accent: "Nothing. Nothing."

"And the Island of Gotland?"

"A little more heavily fortified. That is all."

"It is so near Finland."

"Oh," he laughed at me, "Finland would not touch Gotland."

The bird island of Stora Karlsö, a mile and a quarter long by a mile wide, is a Mecca of ornithologists. It is dearly loved by its Swedish owners, and a trip to its rocky shore is an event in many a Swedish school child's life.

Nearly all Swedish Boy Scouts go there on camping trips. So I was amazed that in a cursory search for information in New York, the only book I could find about it was in our own library at home. The American Museum of Natural History had no references, and the New York Public Library, in answer to a letter, considerably called me on the telephone: "Don't come down. We haven't a thing about it." Our one book, *Stora Karlsö*, by Bengt Berg, is in Swedish, which I do not read, so there are only our personal notes, a page or two in Bonner's *Guide for Tourists* which the Swedish offices produced, and a few

words my Swedish acquaintance, quoted above, had typed for me. His description is too graphic not to quote verbatim:

National Park—No habitation except the lighthouse and a little cottage in which the Swedish Government maintains a Bird Guardian. The island is used by the Gotland farmers for grazing their sheep. It is known for its interesting geological rock formations such as caves and free standing rock pillars. Bird sanctuary. Very rare flowers. Until very recently people had to go to the island by sailboat, but now there is a good connection in summertime by motor launch.

People are not allowed to visit this island without special permission from the Government as in the case of tourists.

Stora Karlsö is about eleven miles

west of the large island of Gotland. Gotland is about the area of Long Island, but is shorter and fatter—75 miles long and about 30 miles wide. It is reached by regular steamboat service from Stockholm to Visby.

To us, as a family, Stora Karlsö is a household word. In 1926 we camped there as guests of a Swedish family—five grownups and four children in all. There is nothing more cherished in our memory than that feeling of ownership and closeness when, for a few hours, over a sunset and the next morning's mists, our intimate family life moved among the birds and cliffs and wild flowers of a dot of land hardly known to the world in general yet rich in scientific and historic interest.

The children, at the adventurous ages of twelve, ten, and seven, were thrilled over turning themselves into Vikings and sailing on the Baltic Sea. They learned the meaning of the words *vik* (harbor), and *ing* (men)

and knew then that the Vikings were "the men out of the harbors." The night-boat from the little port near Stockholm became their dragon ship. It gave concrete instruction of how the old Vikings packed all their arms, food, clothing, and themselves into their tiny craft. The night-boats, evidently always overcrowded, showed their heritage in their use of space. Our two cabins presented us with shoulder-wide berths, about twelve inches apart. Amos and I had often been bedfellows, but even a small child filled that tiny berth. As he said, "Mother slept on air." I was glad to get up at six, as we were approaching Visby.

A thousand years ago Visby was one of the richest cities of the Hanseatic League, an organization as successful as any of all time, in international trade. It has been written that in the twelfth century: "The Gotlanders weighed out gold with stone weights, and played with the choicest jewels.

The swine ate out of silver troughs and the women spun with distaffs of gold." No wonder walls were built around Visby! These walls are still standing and are in good condition, though built in and around 1288. Each of the counties of Gotland built a tower; there were between 36 and 40 of them. Two score towers on a wall that is about 30 feet high toward the sea and nearly 40 feet high toward the land, made a setting for a fairy story for three young Americans. Yet in this case, the stories were all true ones. Visby, no longer wealthy and powerful, has shrunk within these walls as if a child were trying to wear his father's coat.

Such material power had roots in more lasting kinds of prestige. In 1793 John Pinkerton wrote in his *Voyages and Travels*, "But what places Sweden on a level with the great states of Europe is its laws, its government, and the energy of its inhabitants." The fact that the sea-laws in the time of the Hanseatic League were called "Laws

▼ **THE PUFFIN:** Pierrot among sea birds. He looks as if he were trying for more dignity than he feels! Next to the razor-billed auks, the puffin population is the big one on Stora Karlsö

▲ **WE ALL EMBARK** on the stony beach at Klintehamn, on the island of Gotland, for our tiny objective in the Baltic Sea. Captain Malmgren wears his handsome uniform, and the four children pretend they are Vikings

National Audubon Society photo by Allan D. Cruickshank



AMNH photos by R. C. Murphy



of Visby" attests to this city's importance. He also speaks of the Swedish peasant as the "most estimable in Europe." Certainly these modern years of war have proved that Sweden honors and continues the richness of her tradition.

After finding quarters in Visby, my husband* walked over old cobbled streets to search for Captain Malmgren, to whom Count Gyldenstolpe of Stockholm had given a letter. Bob had expected to go alone with Captain Malmgren to Stora Karlsö; but when Captain and Mrs. Malmgren heard of the Murphy impedimenta, the trip was turned into a family party, to include us five and Mrs. Malmgren's sister, Mrs. von Braun, with her little daughter Ilsabe.

In two cars that afternoon the start through an ancient stone gate of the wall noticeably added to the enjoyment of a very glamorous and gay trip.

*Robert Cushman Murphy, Chairman of the Department of Birds at The American Museum of Natural History.

▼ **THE OVERHANGING CLIFFS** of Stora Karlsö. There are birds all over the place, top and bottom, nesting in every cranny, and on the rough beach. The children became absorbed in the baby eider ducks



National Audubon Society photo by Allan D. Cruickshank

▲ **THE RAZOR-BILLED AUKS** were too funny for words—fascinating to watch whether in flight or on their nests. The puffins nest underground, but the razor-bills lay one large egg in precarious places

The distance was given us as "three miles" but, as we went on and on, we learned that a Swedish mile equals six English miles.

To quote from Bob's notes: "Gotland is reminiscent of Nantucket on a large scale. The country is flat, and the extensive forests of conifers are made up entirely of stunted and wind-warped trees. An extraordinary variety of orchids and other lovely flowers were blossoming everywhere in the green meadows. The windmills were whirling in the cool sea breeze, at least such of them as had not fallen into ruin decades or centuries ago. The tall-spired churches, all essentially of one type, reared their very original and modernistic steeples high above the trees, so that they could be seen for many miles. Most of these churches, of which there are more than 90 on the island, date from the thirteenth and fourteenth centuries.

"The houses were mixed in character, the old ones being as quaint as could be imagined, with beam ends projecting under the eaves and an occasional glass shingle among the roof

tiles. The new ones were commonplace red cottages."

Part of our route lay through farm country and part along a charming coast. White and purple lilacs were coming into flower. A cuckoo flew across in front of us into the pines. We saw a jay, magpies, many starlings nesting in bird houses at the farms, and the ever-present hooded crows. In several fields large flocks of brown-headed gulls, with a few examples of mew gulls, were following the plough—a great spectacle to see. Captain Malmgren said that ptarmigan abounded in the forest. Shorebirds, such as lapwings, redshanks, and oyster catchers could be seen in some of the swampy meadows, and eider ducks stood upon the rocks or floated in the water a short distance off shore.

At Klintehamn we walked along a meadow-edged path to a small wooden wharf and boarded the bit of a boat which would take us to Stora Karlsö. An engine helped the sail. Everyone talked Norse lore, and the children imagined dragon ships all about us.

We soon forgot the past in the ex-

citing things that were happening in the present. We were watching for razor-billed auks, and presently one flew near us. The sharp, narrow wings, almost at right angles to the body, whirr a little like those of a hummingbird. One never tires of watching their rapid flight, so different in manner from that of most birds. The same auk inhabits the northern hemisphere all over the world and can be seen from our central Maine coast northward. In winter these birds, which children and grownups were enjoying together in the Baltic Sea, can at rare instances be seen off the coast of Long Island. As we drew near to the perpendicular cliffs of our objective, the auks flew in circles around our little boat, conveying us hospitably to their rocky home. There were also guillemots of two species, several kinds of gulls, and the common tern. The cliffs, rising abruptly above us from the stony shore, were covered with nesting birds as we have since seen them on the Island of Bonaventure, off Gaspe. Many of the same species breed on the two widely-separated islands.

The small plank landing-pier was fairly well sheltered from the surf, whose pleasant salt taste had been in our mouths during the two-hour trip in the bobbing boat.

In a wedge in the cliff stood a log clubhouse, to which we were taken. This is called a shooting lodge, but apparently the laws to conserve the birds were well made and well enforced, for the great numbers of white sprites have never been depleted. I judge from what I can learn now that shooting at Stora Karlsö is a thing of the past.

Above the clubhouse was a little green meadow and above that were the black entrances to the famous caves. In these, prehistoric relics have given convincing proof of very ancient inhabitants. We had no time to go into these caves. I was glad, a few years later, to make it up to the children by giving them their fill of our own American caves, when they explored the unreal loveliness of those in the Appalachians, the Wagnerian depths of the Mammoth Cave in Kentucky, and those of prehistoric man in Arizona.

A picnic on Stora Karlsö! While we three women made it ready, the children went off to coast downhill in the handcar used to get supplies from boats to the base of the cliff, where a crane lifts them high up to the light-house on the summit.

It is an interesting thing about chil-

dren that language is not a barrier. Ours played with Ilisabe as merrily and apparently as understandingly as though the two languages being chattered so fast made no difference at all.

Our table was a large stone slab. Near-by was an outdoor oven, out of which float over these many memory-years, aromas of steak and coffee. As we unpacked the baskets, happy together as women always are who are busy over food with children shouting near-by, the setting of the cliffs, the waves, the wild birds all about us, and the myriad flowers of June, were memorable.

The children presently found still more exciting entertainment than the handcar. An eider's nest near our picnic table was full of eggs, with the mother on them. The story of the eider-down interested both young and old. The birds thickly line the nests with it. The gatherers take part of this soft nest-lining, always leaving enough to keep the eggs warm. The parents reline the nest as before, and once again the gatherers come for a second reaping. It is strange that in spite of this, the birds were so tame there was no particular objection to our close inspection of their home life.

As supper approached, my only trace of concern in the contentment of this precious experience was whether or not my little Americans could bring themselves to conform with formal Swedish manners. The Swedish Court is known to pay more attention to etiquette than does any other in Europe. There is an anecdote that long ago a member of the Swedish Court procured a careful code of behavior from the court of Louis XIV, introducing it in exact and lasting copy. These habits became so ingrained that not even a picnic table would escape their influence. The Swedes shake hands before meals, during meals, and after meals, and thank the hostess and each other. It seems pleasantly to add to the general enjoyment, for the root of these manners is in good breeding. My worry over my wild Indians was needless. They caught the spirit and conformed, and the climax was reached when seven-year-old Amos, saying good-night to six-year-old Ilisabe, swept the ground with his cap as he bowed low from the hips!

Though the rain held off for our picnic, it came on hard after supper, ending all thought of a walk. We went to our comfortable beds soon after the children had all been tucked up. Throughout our Swedish experience

the need for sleep infuriated me. There was so much to do, so much to see, such wonderful sunshine. The June nights were only three or four hours long and never really dark. It seemed too bad to have to waste time sleeping.

By three in the morning it was full daylight, but we stayed in bed till five,



getting up to a raw, misty, and rainy day. Bob's plans for photography were curtailed, even though he and Captain Malmgren lugged the heavy Akeley camera all over the island.

We scrambled along the base of the cliff, aware at every instant of the bird-life about us, from the many nests,

filled at this season, to the bright wings above us. The eider ducks were especially entrancing. Bob wrote in his notes of the black eider babies: "... the latter clung closely to their mothers on the water so that the little raft of birds seemed to be held together by capillary attraction. At the very edge of the

small waves, however, they would now and then break up their close formations and plunge boldly for their breakfasts. After a few seconds, they would bob up again, breathing bubbles."

Auks, guillemots, and funny puffins sat on the ledges above us, as we climbed to the green plateau at the top of the high rough cliffs. Bob wrote: "All the species were coming and going continually. The razorbills have a remarkably even, steady flight. Their wings seem to be exactly amidship of their torpedo-like bodies, and the beats are as regular as clockwork. When they approach a landing place, these birds extend the webs of their feet fully, which gives them a grotesque look."

"The guillemots seem more slender forward and more heavy aft, all of which may be an illusion due to the small size of their bills."

"The path was both sharp and slippery, with mud here and there, and much long, wet grass. The ground abounded in land snails of many color phases, and the ledges above the walk teemed with invertebrate fossils."

"When we reached the end of the first sea-face of cliffs, we came to the gulls. Here, as elsewhere on small islands, these birds have a way of occupying a particular bailiwick. . . . On the tops of the cliffs it was raw and windy, but the weather could not dampen the ardor of the skylarks, many of which fluttered above the green top of the island, pouring out music which the sea-wind could not drown."

Alison and Bob Jr. raced across the grass to the cliff edge. We called them, and all regretfully started down. A second breakfast at nine followed an earlier one, and we climbed again into the small craft which had brought us. Rough waves rocked and pounded us during the two hours' voyage back to Klintehamn. We arrived wet and frozen.

Late that afternoon, again warm and dry, after we had tramped all over Visby, the Malmgrens and Mrs. von Braun came to the steamer to see us off, bringing me a bouquet of violets and wild lilies-of-the-valley, which grow profusely there in June.

The Stora Karlsö trip is long since over. Perhaps little Ilsabe is now telling her children of it, as Alison tells hers. But the gray cliffs, with their enveloping clouds of white-winged birds, stand aged, yet ageless, in the storied waters of the Baltic Sea.



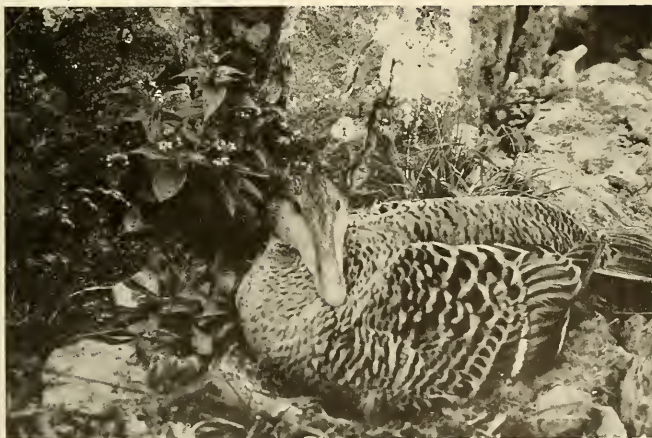
▲ THIS INFANT GREAT BLACK-BACKED GULL will grow to be one of the largest of the common gulls anywhere on either side of the Atlantic Ocean

◀ BOB AND ALISON temporarily became Swedes. Amos is not in the picture because his costume was Norwegian. These two came from Dalecarlia, where our blond youngsters were always taken for natives

◀ THE CURVING, ROCKY SHORE of our bird island had many eider duck nests. The black ducklings swam and played and fed in the convenient waters

▼ A MOTHER EIDER on the rocky beach, with cliffs above and wild flowers everywhere. She was not afraid of the human touch of the gentle children

A.M.N.H. photos by R. C. Murphy



BANDED MONGOOSES AS PETS



By ARTHUR LOVERIDGE

Curator of Reptiles and Amphibians at Harvard's Museum of Comparative Zoölogy

through the wire netting. It was quite amusing to watch the reactions of both.

But it was a few months later that I really came to know these mongooses. I was camping on the lower slopes of the Uluguru Mountains, and my Mkami assistant, Salimu bin Asmani, brought me word that he had seen two young banded mongooses in a near-by village. Their owner, a lad of his own age, was quite willing to sell them, he added. I sent him back with the necessary cash, and the little animals, keeping to heel in a most surprising way, followed him home through the bush for a distance of fully a quarter of a mile. In build they struck me as being rather otter-like, though in size they were but little larger than big rats. At this stage the score of rufous, black, and dirty-white crossbands, so characteristic of the adult, were scarcely discernible, so that at first glance they appeared almost uniformly dark brown.

When introduced to my monkey Kima, they sat up on their hind legs with their short forepaws drooping over their little paunches, meerkat-fashion; then they spat explosively and pretended to bite. Though so small, they were well able to look after themselves, spending much of their time rooting about, turning over stones, or digging for insects with their strong claws. They fought over tidbits in rather quarrelsome fashion while, except when fully fed, they kept up a continual birdlike cheeping and chirping.

But it was their method of dealing with eggs that made them a source of amusement to my friends. If given an egg, these little mongooses evinced the greatest excitement as they rolled it along towards the nearest wall or other solid object. One of them would seize the egg in its forepaws and, clutching it to its chest as it rose upright on its hind legs, would waddle still closer towards the wall, to which it suddenly turned its back. Then, straddling its legs wide apart, it would fling the egg between them at the wall and spring around with a great display of eagerness to set about devouring the contents if the shell was broken. I discovered that a cockle shell was just as effective and much less expensive for such displays, for, though they never succeeded in breaking it, the mongooses went through the same routine as for an egg. Instead of being discouraged, the futility of their

MENTION a mongoose and nine times out of ten the conversation will drift to cobras, so intimately are the two associated in the minds of most people as a result of the activities of an Indian species. Yet of the 21 different forms of mongoose which I have collected in East Africa, few indeed showed any partiality for snakes, most of them being about as omnivorous as their North American relatives—the skunks.

Among them the banded mongoose is of outstanding interest by reason of its gregarious nature, which finds expression in communal hunting and results in this species readily accepting human companionship when offered it at an early age. As a species the banded mongoose ranges right across Africa from Portuguese Guinea in the west to Eritrea in the east and southwards throughout the great continent in all suitable regions that are free of forest.

My first acquaintance with the East African form (*Mungos mungo colonus*) was at Morogoro in central Tanganyika Territory. There, when returning to my quarters one wet evening after a torrential downpour

which had left the roads half-flooded, I noticed a dozen soldiers watching some small object in the road. It was a mongoose kitten, looking very forlorn and from time to time uttering a shrill cry. The little creature was just over a foot in length from end of nose to the tip of its somewhat stumpy tail, its fur a very dark brown. Presumably it had been washed out of a drain or some other retreat by the heavy rain. It ran well, and when covered with a towel attempted to bite through it. After carrying it back to the factory in which I was bivouacked at that time, I provided it with milk, raw liver, and boiled meat, but it touched only the milk and in that it lay down!

All the time it maintained a monotonous whistle, not unlike a single note of a canary's song. The immediate effect of its cries was to elicit an answering call from a stray cat that had established itself downstairs, such a call as any puss might use when answering her kittens. Presently the cat appeared through a belt hole in the floor and, approaching the box with considerable caution, stood upon her hind legs and viewed the prisoner

efforts served only to increase their eagerness, which became almost unbalanced in the intensity with which they vied with each other in violent attempts to smash the mollusk. Between times they would fight desperately for possession of the shell, though often, after gaining it, the possessor would fear to fling it lest his waiting relative should filch it. This distrust led to much unnecessary waddling about for position.

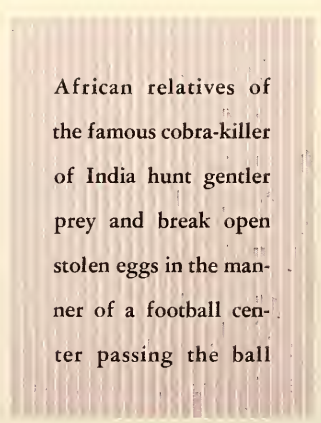
One day a dead spitting cobra was brought to me; it had been killed in the act of swallowing a baby chick. I cut off its head to prevent an accident with the poison teeth, then presented the body to the kittens to see what they would do. It was probably the first snake that they had ever seen. They approached it with the greatest caution and sprang back again and again, apparently with the object of "drawing it" if alive. As they repeated the maneuver the bristly coarse hairs of their tails stood on end. In time, finding that the snake made no response, the mongooses accumulated sufficient courage to attack its tail, biting and worrying it, then dashing away till, tiring of play, they gorged upon the entrails. After such a meal their small paunches were very rounded, and they might be seen slumbering in the sunshine, frequently at the foot of the monkey's pole, for Kima and they soon became fast friends. In fact, during lazy moments, which occurred only when gorged, they would sprawl on their backs and let the monkey inspect their fur most minutely. Except when traveling, the little carnivores were never caged, and taking full advantage of their freedom, on most mornings they would depart for the neighboring bush on foraging expeditions of several hours' duration.

Once, after a tiring march that had begun long before dawn, I was resting on the outskirts of Tabora when I noticed eight banded mongooses in all manner of indolent attitudes, sunning themselves within 20 feet of a main road along which a noisy stream of natives was passing, the time being about 7 A.M. My porters, having dropped their loads, were moving about gathering firewood within 50 feet of the little beasts, which took not the slightest notice of them.

Another time at Pooma, near Singida, I saw ten banded mongooses sitting erect on a termite hill, intently watching a flock of guinea-fowl which

were feeding towards them across the open, the nearest bird being only 20 feet away. So preoccupied were they that I was able to shoot two which were sitting close together, but one fell down a hole in the termitarium. The other proved to be a very light sandy, or straw color, excellently adapted to life in such arid thornbush steppe. On showing it to Salimu, he declared that the variety was well known to him and that probably all of those in that thornbush country would be of a similar bleached appearance. Unfortunately for this theory, when we dug out its dead companion next morning, it was found to be the typical nut-brown hue—a grizzled brown animal banded on the hinder part of the body with dirty white or reddish white, and black. In length the head and body measured sixteen inches and the tail as much as a foot, though it is unusual for the latter to exceed eight inches.

Sometimes a score of the animals form a hunting party and keep in touch with one another by their continual chirping cries. Meanwhile they



African relatives of
the famous cobra-killer
of India hunt gentler
prey and break open
stolen eggs in the man-
ner of a football cen-
ter passing the ball

turn every stick and stone, running together when one mongoose, discovering something out of the usual, betrays the fact by a different call. Examination was made of the stomachs of all mongooses shot for preservation. One held three lizards, two of which were skinks and the third a rare amphisbaenid (*Geocalamus modestus*) of which three types taken 40 years before were the only examples known. Another had eaten a grasshopper, a large carabid, and the larvae of a beetle. One Morogoro mongoose had consumed three frogs, two centipedes, four slugs, a carabid beetle, cock-

chafers, cockroaches, locusts, grasshoppers, and a large spider. The stomachs of these animals are relatively large, and the variety of their menu gives some idea of their omnivorous diet. Incidentally, it serves to show how useful a pack must be in keeping down many undesirable agricultural pests, for the quantity consumed by such a pack in the course of a single day must be enormous.

In captivity I fed them chopped meat, eggs, milk, and water as staples, but when possible it is better to give them complete liberty so that they may contribute to their own support by a more varied diet. As already indicated, snakes did not play an important part in the lives of these African mongooses, but whenever one of the animals saw one, his interest was aroused and he displayed excessive caution. Even when a common and harmless species like the brown house snake (*Boaedon lineatus lineatus*) was liberated in the open, an adult mongoose treated it with the greatest respect, running after it to bite the tail, then springing back before the snake had time to strike.

When four of these mongooses were brought to me full grown, I confined them in a cage. One-fourth of the front, instead of being wire netting, was a wooden door which slid up and down in a groove. The mongooses soon discovered that they could raise it slightly by pressing their noses against it. Apparently a second mongoose was required to slip its claws into the aperture and raise the door still further before one could get out, so it is doubtful if a solitary animal could have escaped. As it was, all of them escaped a great many times, chiefly owing to the carelessness of their native attendant in failing to fasten the catch which secured the door. It seemed as if the mongooses tested the door each time he opened it to put in food or clean out the cage; at least they never seemed to lose an opportunity of which they could take advantage. With the exception of one animal which escaped permanently, none of the truants went far. They usually retired behind the cage and remained there until discovered, whereupon a wild chase round the room invariably resulted in recapture.

Constant traveling is not good for small creatures and makes it difficult to gain their affection. I recall three mongoose kittens that were brought to me in mid-June when I was camp-

Continued on page 96

The Bath Sponge

An Intimate but Humble Friend of Man

By GEORGE H. CHILDS

*Department of Invertebrates
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LIKE many fossil animals which are far more impressive, the humble bath sponge, still very much alive despite its present market scarcity, is known to most of us solely by its skeleton. This skeleton, so readily brought to mind by the small photograph (p. 85), can hardly prepare us for the shock we would receive on seeing its living owner, a creature as far removed from our conception of physical cleanliness as any creature could be. An ordinary skeletonized sponge, immersed in rancid oil and then lightly rubbed with some sooty

material, would give an approximate idea, for in reality the living bath sponge is an amorphous mass similar in general outlines to its skeleton but overlarded and impregnated with slimy gelatinous tissue ranging in color from jet black to dirty brown.

But let us renounce our repugnance and show the bath sponge the respect due it as a fellow living animal. It gets its food by straining microscopic plants and animals from enormous quantities of sea water, constantly flowing through its tissues. On close examination its whole slimy surface is seen to be dotted with small, conelike elevations (conuli) at about $\frac{1}{8}$ of an inch intervals. These serve

merely as fleshy coverings to the free endings of the principal elements of the skeleton, which project slightly beyond the level of the surface. Interspersed among the conuli and occurring at about the same frequency are comparatively large pores of variable size, which function as escape vents for the water in the sponge and are, therefore, known as exhalent pores. Upon still closer examination we find that the areas between the conuli and the exhalent pores are perforated by innumerable, very minute inhalent pores, through which the sea water passes into the interior of the sponge. This is one of the instances wherein the sponge stands unique in the animal kingdom, for of all creatures that have their exits and their entrances, only in the sponges are the former more conspicuous than the latter.

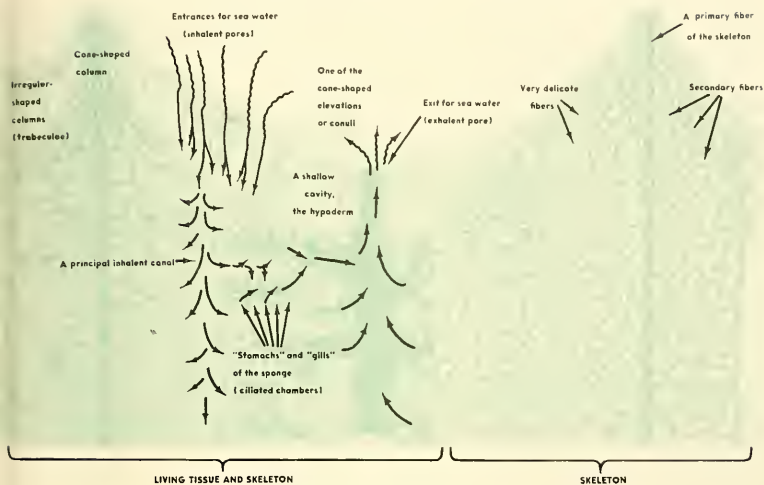
Having explored the surface of the living bath sponge, let us see what the interior has to offer us. First we dis-

▼ ENLARGED model, in which approximately $\frac{1}{8}$ inch of bath sponge is reproduced in wax and glass. The model has recently been put on exhibition in the American Museum's Darwin Hall. It was constructed by Herman Mueller in collaboration with the author and under the direction of Dr. Roy W. Miner

AMNH photo



▼ THE ARROWS show the movement of the sea water from which the sponge takes its nourishment in the form of microscopic plants and animals. Important parts of the sponge shown in the model opposite are named here



our hair and nails, and consists of three kinds of fibers. The principal fibers are the large ones already mentioned in connection with the cone-shaped elevations, and these follow a course parallel to the principal inhalant and exhalant canals. Branching off from the principal ones are a network of finer fibers, interconnecting them. Finally bundles of very delicate fibers occur in the roof of the hypoderm and its supporting columns and invest all the principal canals of the inhalant and exhalant systems. In the process of bleaching, these finest fibers are so completely torn away that in the average bath sponge skeleton nothing remains to indicate the roof of the hypoderm, the trabeculae, or the actual outlines of the canals.

The foregoing account, though very incomplete, is designed to explain the main features shown in the model depicted on these pages. This model, recently completed for exhibition in the American Museum, is a diagrammatic wax and glass reconstruction of a small section of a bath sponge only about $\frac{1}{8}$ of an inch wide, enlarged 130 diameters. The right-hand portion of the model shows the skeleton alone; the left, the skeleton combined with the living tissue.

cover that the surface itself is just a thin skin roofing over a shallow cavity (the hypoderm) and penetrated by the tiny inhalant pores. From the floor to the roof of the hypoderm stretch three kinds of columns. The largest are conical and contain the ends of the principal skeletal elements as central axes. A second type are cylindrical and contain the tubes through which the sea water leaves the sponge. The third kind of columns, called trabeculae, are by far the most numerous and are irregular in shape. These serve only as supporting pillars for the roof.

On the floor of the shallow cavity we find a second set of inhalant pores, larger and less numerous than the ones that penetrate the roof. These lead directly into the principal inhalant canals, which like the principal exhalant canals extend downward through the sponge mass and form many coalescences with their fellows as they approach the base of the sponge. Thus the principal inhalants, smaller and more numerous than the exhalants, cannot be reached by the inflowing water until the shallow cavity has been traversed.

From both sets of canals many greatly branching tributaries are given off; but never will we find the terminal branches of the two systems directly coalescing, for between them is a vast number of elliptical chambers of uniform size, through which the sea water must pass to go from one to the other. These organs are the stomachs as well as the gills of the sponge. The peculiar cuplike cells which line them not only digest food matter from the water but also possess vibratile hairlike processes, or cilia, the collective movement of which keeps a constant current circulating through the sponge. Thus the digestive and respiratory activities of the animal depend entirely on these cilia, and the structures in which they occur are consequently known as ciliated chambers.

Finally, let us turn to the skeleton, which is the bath sponge's badge of admission to the bath tub or wash basin, places to which the creature's many more attractive but prickly relatives have no entree. This skeleton is made up of a very tough but yielding substance known as spongin, which is chemically related to the keratin of

▼ THE COMMON BATH SPONGE: only its skeleton

AMNH photo





AMNH photo

THE PASSING OF THE Passenger Pigeon

By ROY L. ABBOTT

*Professor of Biology,
Iowa State Teachers College*

◀ THE BIRD whose flocks darkened the sun over much of northern United States: the extinct passenger pigeon, as displayed in a Museum case

WE human beings are seemingly so indifferent to the death of one of our own kind that for us to give thought to the death of a bird appears strange, indeed. Yet, thousands of people took serious and melancholy notice of the death of a certain bird back in 1914. For that bird, a Passenger Pigeon, captive for many years in the Cincinnati Zoological Gardens, was the last one of its kind in the whole world. Its death marked the close of what was perhaps Nature's greatest dynasty of birds. Its history is one of thoughtless destruction and ruthless persecution without parallel.

The ancestors of those now vanished hosts were here, of course, when the first colonists came. In the awe-inspired language of an early chronicler, they existed in multitudes "like the quayles which fell around the campe of Israel in the wilderness,"—multitudes which fed and bred in the almost unbroken sweep of forests

from the St. Lawrence westward to the Dakotas. Migratory in habit, they trekked southward en masse each fall and northward each spring.

Those beautiful, long-winged, bluish and fawn-colored birds were much like the common turtledoves, but were larger and half-again as long. On taking off in flight, they clapped or rattled their wings, but never made that whistling noise with them so characteristic of the turtledove. Nor did they coo in the long, drawnout fashion of our doves; aside from a weak, short coo, their notes were rather harsh—a series of shrieks and clatters and clucks. They drank in the peculiar sucking fashion of all pigeons, but when banks were too steep for them to get down to the water, they were said "to alight on the water with wings raised, drink, and rise again."

They nested in vast communal areas sometimes a hundred thousand acres or more in extent, in both the broad-leaved and coniferous forests

of Canada and northern United States. Often they built a hundred nests in one tree, each usually with only one white egg, often visible from below through the bottom of the flimsy nest. Both sexes took part in the raising of the young. Incubation began as soon as the egg was laid, and it was guarded, turned, and sat upon continuously until hatched, a vigil of 14 days. With a regularity almost approaching that of our worker-shifts in a modern industrial plant, the males and females changed places on the nests twice daily. Thus it came about that when foraging for food during the nesting period, the flocks were all males or all females depending upon the time of day.

One is almost tempted to imagine that the parents realized that the food near the nesting site should be left for the fledglings when they first quit the nests, for the adults were said to travel often long distances for their own food. This consisted of acorns,

beechnuts, oak galls, berries of all sorts, weed seeds, and even insects and worms. All such provender was stuffed into their capacious crops and ground up by their tough, muscular gizzards. A single bird could eat a dozen or more acorns at one feeding. Some of this was later brought up for the young birds, which fed by thrusting their beaks deep into the throats of their parents in the manner of all pigeons.

It required only 27 days for the young birds to become large and strong enough to leave the nest and feed themselves upon the abundant food remaining near by. And at this period, the parent birds left the young to shift for themselves.

It is difficult to paint a clear picture of one of these vast roosts or nestings. Two or three thousand millions of warm, pulsing, eager bodies crowded into one communal area of trees, even if those trees covered half a county, must have been a breathtaking sight. As they flew home from feeding, tier upon tier and mile after mile, their bodies eclipsed the sun. And as they arrived and changed places at the nests the thunder of their wings in the treetops was like the roaring of a tornado. Great limbs and even the trunks of trees broke and crashed beneath the sheer weight of their bodies, and the falling of the trees often maimed and killed many

People who thought that conservation laws didn't matter scarcely believed that one of America's most abundant birds could be killed as dead as the dodo

birds young and old. Down beneath this bedlam of clacking, cooing, rampant life, the wolves and foxes and bobcats and other predators took their toll, as did the hawks and owls and eagles by day and night in the air. Likewise, the Indian came and killed what he needed for food, but all of these takings were trivial tolls, the necessary "expendables" in the great drama of pigeon life.

How do we know all of these facts? Because they have been set down in hundreds of written records. Because for 350 years after Jaques Cartier first saw "wilde pigeons" on the St. Lawrence in 1535, men never tired telling of them. Confronted with such a phenomenon, they could use little but superlatives. Listen to the words of a few of these early observers.

"I have seen a flight of pigeons that to my thinking had neither beginning nor ending, length nor breadth, and so thick I could not see the sun." That is Josselyn, a Frenchman, speaking in 1672.

"One would have thought" says the Baron La Honton, speaking of a

flight of pigeons he saw in 1687 near Lake Champlain, "that all the 'turtle doves' on earth had chose to pass through this place. The trees were covered with that sort of fowl more than with leaves."

Lawson, as quoted by Forbush speaks of "prodigious flocks which broke down the trees . . . and cleaned up all the food in the country, leaving scarcely one acorn."

Their numbers are "beyond conception" writes Professor Peter Kalm, about 1740, and adds that they came to Pennsylvania in such incredible flocks as literally to appall the inhabitants.

So much for the earlier writers, but the later ones were no less awed by the spectacle. Alexander Wilson, describing a flight he witnessed in 1806, says: "I was astonished at their appearance. They were flying with great steadiness. From right to left far as the eye could reach, the breadth of this vast procession extended, seeming everywhere equally crowded."

These birds were flying to a nesting place—some two billion of them, Wilson believed. This incredible mass of life—a half million tons of flesh, if we allow only half a pound to each bird—naturally required a lot of food. Wilson computed that they would consume 17 million bushels of nuts daily. This mass of food is far greater in bulk than that required as a day's ration for all the soldiers under arms in the world today.

Audubon saw a flight that continued for three whole days. He estimated that a billion birds passed over and around him in three hours, and this was only a small part of the whole. Even as late as 1866 Ross King tells of a flight he saw in Canada "which obscured the sun for fourteen hours, and which must have averaged 300 miles in length by a mile wide."

But unbelievable as were the numbers of these birds as told by Wilson, Audubon, Ross, and many others, the decline of the pigeon dynasty had begun in New England long before these men wrote. Indeed, it began almost with the coming of the first

THEY LIVED on acorns, nuts, berries, and insects; and their daily ration was greater than that of all the soldiers under arms in the world today. We shall never see them again, for not one of the birds remains alive.

AMNH photo



white men. For Champlain in 1607, after speaking of the "infinite number" of pigeons, adds the significant comment that he and his men took a great many. Champlain's action in taking "a great many" became the standard of procedure with the men who followed him. "It is incredible what numbers of them are killed daily," remarks Governor Winthrop of Massachusetts. One family "has been known to have killed one hundred dozens of these birds," says another writer.

This was the general pattern of destruction; hence within 50 years after the landing of the Pilgrims, Josselyn was to say that "They [the pigeons] are of late much diminished, the English taking them in nets."

Yes, in nets, and with guns, clubs, and every other slaughter device obtainable. Audubon, as quoted above, after speaking of the great flight, describes the banks of the Ohio as being fairly lined with men and boys armed with shotguns and every sort of weapon, who kept up an incessant fusillade upon the low-flying birds. Mark Twain, in his autobiography, describes his pigeon hunting in Missouri. "They were clubbed to death with sticks," he says, "guns were unnecessary."

Not only did men shoot them for their own use as they passed overhead, but as soon as a market became established for these unfortunate birds, hunters by hundreds from all parts of the country went to the nesting grounds and camped there for days. Their sole occupation was the slaughter of pigeons, particularly the nearly-grown but still helpless squabs in the nests.

The pigeons were worth from \$1.00 to \$1.50 per dozen in the Eastern markets. No sportsmanship whatever entered into their capture. The pigeoners actually chopped down the nest-laden trees, taking care in felling them that they would crash into and knock down other trees with their broods. Two hundred squabs were sometimes gathered from a single tree.

But still more destructive methods were used. Baiting with corn, wheat, or other grains to attract the birds proved even more remunerative to the pigeoners. For once assembled by the thousands over these baited areas, the birds became a target for wholesale killing by guns or easy victims of the clever nets. A shotgun fired into

one of these closely grouped masses often yielded more than a hundred birds, and when a swivel-gun, a sort of cannon charged with a pound or more of small shot, was used, enough birds were killed at a single discharge to feed a whole community. Cooper, in *The Pioneers*, has his hero, Leather Stocking, turn away in disgust at the destruction produced by such a device.

But the nets were even more effective killers than the guns. It was not uncommon to take up to 1200 birds with a single throw of a net. Half a dozen such throws would yield \$650, and the New York City markets required 100 barrels of birds daily! Many birds that were taken alive, however, were reserved to be killed later in a more spectacular way. For the so-called "live-pigeon shoots" so popular in this country back in the 80's used passenger pigeons as targets for the competing sportsmen. At Coney Island, in 1881, 20,000 of these birds were so used in a "shoot" that was held, ironically enough, under the auspices of the New York Association for the Protection of Fish and Game.

And so the ruthless killing went gaily on, perhaps reaching its spectacular climax at Petoskey, Michigan, in 1878. Various figures have been given as to the number of birds killed at this place—a billion according to Professor H. B. Roney. This figure is doubtless too high, but there are records to show that at least 300 tons of birds were shipped from that place in the few weeks the slaughter continued. Some two thousand persons were engaged in the business, in spite of a state law prohibiting the discharge of firearms within a mile of the birds' roosting place.

But the Petoskey killing of 1878 was not quite the end of the pigeon drama. Destruction of the birds, although to a lesser degree, went on in Michigan until 1881, and throughout the whole country for some 15 years thereafter. Professional pigeoners by aid of telegraph and railroad located and pursued the birds relentlessly as long as a flock large enough to make its killing worth while could be found. A considerable nesting took place in Pennsylvania in 1886 with the usual slaughter until the birds were driven away. Another was reported from Indian Territory in 1889; and other minor nestings occurred here and there throughout most of the 80's.

But from 1880 onward the birds disappeared rapidly all over the United States, and by 1895 the business of taking pigeons for the market was clean gone for the want of pigeons.

W. W. Judy and Company of St. Louis, marketmen, who probably handled more pigeons than any other firm, reported that their last shipment of pigeons had come in 1893 from Arkansas, and that their netters were then idle.

Yet even as late as 1888 there were still enough pigeons left in Michigan to give Mr. William Brewster hope that they would not be exterminated. This hope was short-lived. For only 200 birds were reported from that state just ten years later, and by 1900 only 50 were reported. Similar or even poorer reports came from the other "pigeon states," and perhaps the last accurate record of a wild passenger pigeon in the United States is that of one killed in Connecticut in 1906. One was reported as killed in Quebec, Canada, in 1907. And with the death of the captive in Cincinnati, the species became extinct!

It has often been said and commonly believed that the passenger pigeon disappeared suddenly from the world, that it "went off like dynamite." Men said, for example, that the survivors of the Petoskey massacre, fleeing northward, were drowned in a storm over the Great Lakes, and this in spite of the fact that there were fairly large nestings near Petoskey for several years afterward. Other dreamers had the pigeons leave us for South America, still others believed that immense numbers perished while crossing the Gulf of Mexico. But there is no evidence of these birds in South America or that they ever migrated across the Gulf. Others said that they perished as the result of a sudden and fatal epidemic.

Of course, thousands of pigeons undoubtedly died each year as the result of drowning while crossing our Great Lakes, or by being overwhelmed and frozen by sudden storms, but to say that these factors were responsible for the extinction of the wild pigeon is sheer nonsense. Nor was their disappearance nearly so rapid as has been believed. As already pointed out, they had begun to decline in New England within 50 years after the colonists came, and their decline and final disappearance from the country

Continued on page 96

NATURE'S SECOND-HAND MAN



By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON

IF one of these little animals takes up housekeeping in your cabin, the night will be filled with more noises than you would believe could be produced by a creature weighing only about three-quarters of a pound. From darkness to dawn your sleep may be broken by its scurrying, squeaking, jumping, and knocking things about. Many a tenderfoot has awakened in terror, certain that the racket was caused by a grizzly bear at least, maybe a family of bears.

Since the culprit is not more closely related to the pestiferous house rats than a dog is to a bear, it is a pity that he has been called wood rat, pack rat, or trade rat. To be sure, he is about the same size and does look somewhat like the Old World rats introduced wherever white men have gone. But wood rats are much more attractive

animals, with more hairy tails and shorter white feet, and are really delightful rodents.

The best known kind is probably the bushy-tailed pack rat, usually found in the Spruce and Fir country, whether in the mountains of northern Arizona or near sea level in the north. All kinds have very similar habits, but this is the one usually called "trade rat." His tail instead of being rounded and thinly haired is almost as furred as a squirrel's and is somewhat flattened. His large ears are naked and translucent in the light, and his big "shoe-button" eyes are shiny. His whiskers, the longest of which are almost three inches, twitch nervously. Only rarely does a pack rat come out before dusk, but I have seen them playing about their nests in the afternoon.

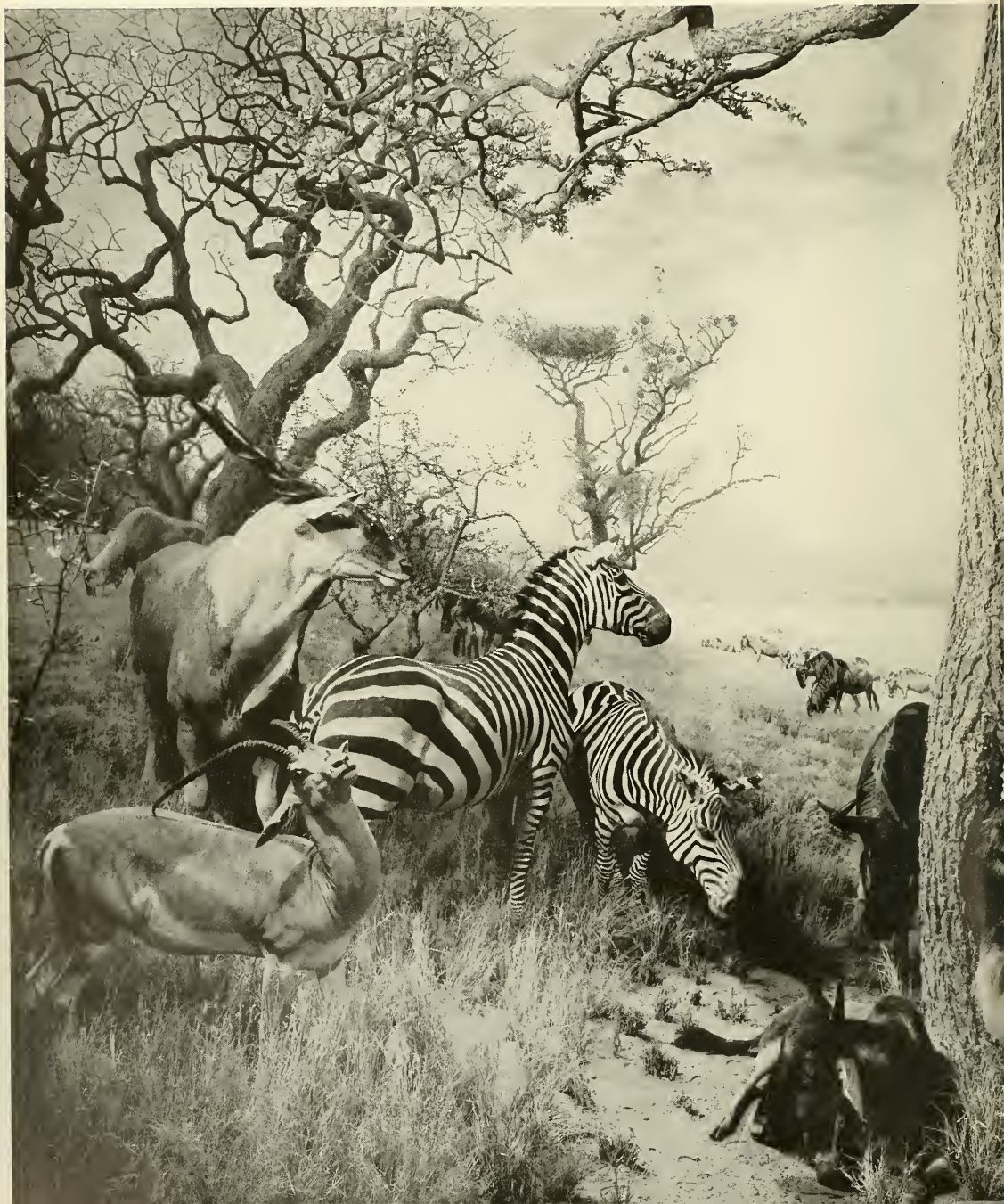
They make large nests in rock clefts, caves, or tangled underbrush. The nests are piles of twigs, chips, pebbles, bones, pine cones, dry horse manure—almost anything the owner can carry.

Material is constantly added to the pile, and the accumulated quantity gets to be astonishing. If a museum collector does not fasten down his mousetraps with wire, many of them will be carted off to be added to the trophies of the home. In a camp, the spoons, forks, keys, even watches and gold nuggets have been carried off by these acquisitive creatures.

Frequently in place of the missing article you will find a chip or a pebble, as if the pack rat considered "fair exchange no robbery." No wonder miners and trappers in the West supposed that this is what the wood rat thought, but a more probable explanation in most cases is that the "trader" was carrying one article to his nest when he saw a more attractive object. Without pockets, he must drop his load to pick up the new treasure. It is more difficult to explain, though, if a drawer of nails, bolts, and hardware is cleaned out and filled with twigs and rubbish. Perhaps there is a trading instinct in these trade rats.

Glimps

▼ THE MARKINGS on zebras are always different, like fingerprints. These are Grant zebras, which are closely related to the extinct quagga, an animal whose stripes were restricted to the region of the head and shoulders. The quagga vanished from the African scene a little over 70 years ago. To the left is an eland, and in front of it a Roberts gazelle. The animals on the right are gnus



es of African Wildlife

Several exhibits not previously brought to the attention of readers of *NATURAL HISTORY* are a reminder in these days of restricted travel that a visit to Akeley African Hall is like a 10,000-mile trip through the continent of Africa

AMNH photos

ENORMOUS herds of animals are still to be found in the plains country of East Africa. One of the classic localities for the naturalist and photographer is the Serengeti Plains, not far below the equator in Tanganyika. The photographs on this spread show two views of a typical assemblage of animals in this region as displayed in one exhibit in Akeley Hall. The entire scene, including every leaf, rock, and blade of grass, is reproduced with almost microscopic accuracy. The setting therefore represents as nearly as science and art can achieve, a section of Africa brought to New York City for the enjoyment and education of the public.

► **DOMINATING** this view is a magnificent hartebeest, a swift and excitable animal. Individuals often play together. In the foreground are three Thomson's gazelles, adults and young. The animal in the background is a Roberts gazelle





▲ OSTRICHES, the largest living birds, dwell in relatively flat, open country from the Sahara to South Africa and in adjacent parts of Asia. Here we see a family group, with several newly hatched chicks. The parent birds are ready to give battle to a group of approaching wart hogs, not visible in this view. The powerful kicks these birds can deliver are good reason for an intruder to stand his distance, whether he has predatory intentions or not. The demands for the white plumes of males led to great slaughter in the nineteenth century. But the development of ostrich farms greatly reduced the pressure on these birds while their plumes were in fashion

◀ THE YOUNG OSTRICH blends into the background of grass and soil that forms its typical homeland. But a closer view shows a creature that has distinctive character, if not plumage

► NEAR THE BOUNDARY between Liberia and the Ivory Coast, an adult chimpanzee and its young are here shown high in the trees. They are part of a group who have built sleeping platforms for the night. These nests are quickly constructed and are generally used only once. A chimpanzee family consists ordinarily of an adult male, one or several females, infants and young of various ages. Females bear usually a single baby, which reaches maturity in about nine years if a female, twelve years if a male. These apes have keen senses of sight and hearing. They are relatively intelligent and resemble children in their curiosity and powers of imitation. In early mornings they often dance and beat on trees, producing sounds like those made by native drummers



▼ AGAIN on the Serengeti Plains in East Africa, a pack of Wild Dogs is depicted on a desolate landscape against the setting sun. These animals usually hunt in the early morning and evening; and when the moon is full they may hunt during the night. A number of forms have been described, ranging over most of the plains regions from the Tropic of Capricorn north to the Sudan. These are of the race designated *Lycan pictus lupinus*. Packs of hunting dogs are very destructive to game. They feed chiefly upon the smaller antelopes but sometimes attack the larger ones and also raise great havoc with domestic herds



YOUR NEW BOOKS

SMOKIES AND THE BLUE RIDGE • NORTHERN FISHES
MICHIGAN SHRUBS • BURNING AN EMPIRE

BURNING AN EMPIRE

----- by Stewart H. Holbrook

The Macmillan Co., \$2.50

THIS book is the story of American Forest Fires, told most graphically by one who knows how to get suspense and action into his writing. The foreword is by Colonel William B. Greeley, Former Chief, United States Forest Service. In this introduction, Colonel Greeley says: "Here for the first time American literature has vigorously portrayed the role of the forest fire in human lives and frontier communities. We are indebted to Stewart Holbrook for this vivid writing of a part of our history which is understood by few Americans and unknown to most of them."

In this volume the author tells the stories of historic forest fires from that of 1825 in the Miramichi Valley in New Brunswick—the worst the Dominion of Canada has ever experienced,—to the terrible Tillamook Fire of 1933 in Oregon, which beat all records by burning twelve and one-half billion feet. His first chapter is a vivid account of a forest fire he himself witnessed, which burned over two thousand acres and cost one human life. He then turns to forest fires in general, and concludes that "during the past century and a half they have probably killed more pioneers than all the savages put together; and they have also killed more forests than all the lumberjacks have cut." The one of 1894 in Pine County, Minnesota, cost 418 lives. The ghastly fire of Peshtigo, Wisconsin, took five times as many lives as were lost the same night in Chicago by the fire which almost totally destroyed that city on October 8, 1894.

In the concluding chapters, modern methods of preventing fires and of fighting them are described as well as the work of reforestation. The book closes with a few ballads of forest fires, and a bibliography. Altogether it contains much epic material and it is well told.

CLYDE FISHER.

FOXY'S LION TALES

----- by Arnold C. Schueren

Privately published edition, limited to 990 copies.

WHILE *Foxy's Lion Tales* is primarily a narrative on the tracking and hunting of the mountain lion in southwestern Utah, it portrays from personal

observation a side of this big cat's character that has not been described elsewhere. There are, as the author states, many articles and stories that give people the wrong impression as to its ferocity and predatory habits. Mr. Schueren who has hunted lions in many states, Mexico, and Central and South America is well qualified to give us the actual facts from his own experiences.

He definitely believes in a conservative control of all native wildlife which he illustrates in the following words: "It is true that the lion is a predatory animal. On the other hand, as strange as it may seem, he is also of benefit to our wildlife. A good sportsman should not aim to kill off all the cats, but rather lend his aid so that they will not be exterminated, but controlled."

"My philosophy has always been that there must be a reason why the good Lord put each animal on earth. Mountain lions eliminate the weak game animals. That is actually a benefit since when you cut out the weak game only the strong remain." Later Mr. Schueren states, "Smokey and I were watching a herd of deer this last trip. One had his hind leg shot off and another a crippled front leg. . . . They were maimed during the last hunting season. In a thickly populated deer territory like this, a cougar is necessary. . . . I didn't care much about killing these cats, so now we are concentrating on the big Toms and simply photographing the bitches and cubs and then letting them go again."

Foxy is a thoroughbred Beagle hound, and the story is centered around his initiation to trailing and treeing the mountain lion under the expert supervision of Smokey Emmet, a professional guide in the Bull Valley Mountain region. The book contains 158 pages with 52 photographs, two maps, and two illustrations. It is written in an attractive manner and printed in clear type.

GEORGE G. GOODWIN.

NATURE LOVERS' LIBRARY

Six Giant volumes, 8½ x 11½, 2,000 pages, weight 20 pounds. Lives and habits of 3,000 species of birds, mammals, reptiles and fishes described by world famous Naturalists; 1,000 species illustrated, 300 in natural colors; published at \$29.50. The Literary Mart, 411 West 125th St., New York, offers this set to members for \$19.50, returnable for full refund after 5 days' examination. Nature Encyclopedia edited by G. C. Fisher, 5 volumes with 200 colored illustrations, given free on orders mailed in February.

PAJOROS NUESTROS ("Our Birds")

----- Poems by Juan Burghi. Plates in color by Salvador Magno

Guillermo Kraft, Limitada, Buenos Aires

SOMEONE once noted that the proportion of ornithologists in a population may serve as a satisfactory index of civilization! To put the matter another way, the number of individuals who take an interest in birds is high in acknowledged centers of enlightenment.

It is therefore gratifying to receive from the largest city in South America a book which reflects a deep-seated folk interest in birds and which, through the medium of both literary and pictorial expression, indicates an evolution of sentiment that cannot possibly be a mushroom growth. The work, which is a book-lover's treasure, comprises 35 poems on Argentine birds, accompanied by color plates of each.

Let it be said at once that the paintings are of a high order—simple, faithful, and strikingly decorative. They would do credit to the foremost contemporary portrayers of birds in the United States. Some of them suggest the style and smartness of Audubon, who, at his best, attained a peak that has never been surpassed.

For one not deeply steeped in the genius of Spanish, it is more difficult to comment on the verses, but the reviewer finds them charming in both form and content. More important is the fact that they obviously reflect a feeling that springs from a people rather than merely from an individual. Poems about birds do not sprout from soil in which only a single seed has germinated.

The species memorialized comprise those most familiar to the inhabitants of the extensive terrain of Argentina. One of them is the *Hornero*, which virtually fills the place of a national bird. Among others are a lapwing, wren, pipit, tinamou, mockingbird, burrowing owl, swallow, and a flycatcher which sings its own name—*Benteveo* ("I see you well"). Still another subject, the lesser yellow-legs, belongs jointly to all Americans because it nests in Canada and winters on the pampas of our southernmost neighbor.

The publication of this book in at least two relatively large editions bodes well for an inter-American understanding that should go far toward preserving the bird life of the New World.

R. C. M.

THE OUTDOORSMAN'S COOKBOOK

----- by Arthur H. Carhart

The Macmillan Company, \$1.95

THIS book for the outdoorsman, as the title implies, does not assume to add anything to our knowledge of wildlife. Nevertheless, the success of every trip in the field,—be it for photographic purposes or for the studying of wildlife, collecting, scientific research, hunting, fishing, or just plain camping,—depends on the health of the party. To do any job thoroughly one must have suitable food and shelter, and these are of especial importance when one is subjected to the strenuous life in the sticks. Having spent a winter camping in northern Siberia, many months in the American Arctic, Africa, Persia, and Turkestan, I have a fair idea just how important the matter of food can be for either a long or short period in the field.

In this book the author gives complete nutritious menus for each day of a trip. Different provision lists are planned for every type of excursion, from the roughest back-pack trip to the most luxurious expedition. The reader is told how to estimate the amount of food necessary for a given trip, how to pack it, and the number of camp cooking utensils required, including the size and type of cooking stoves.

The average individual has not the remotest idea how to butcher game or use it to the best advantage. Meat spoils quickly in the summer if not properly protected; on the other hand it is not advisable to eat a freshly killed animal. All this is explained very clearly, with accompanying diagrams by Mr. Carhart. Furthermore, he tells how to purify drinking water, and there is a chapter on how to build the various types of campfires. In fact, every angle on the preparation and cooking of food in camp is carefully and adequately planned. Anyone following the instructions cannot help but make a success of the food end of a trip.

The book contains 211 pages and is illustrated with diagrams. It has a complete index.

GEORGE GOODWIN.

SHRUBS OF MICHIGAN

----- by Cecil Billington

Cranbrook Institute of Science, \$2.50

THIS is Bulletin No. 20 of the Cranbrook Institute of Science, the series to which the volume belongs being prepared under the supervision of the Director, Dr. Robert T. Hatt, and "designed to promote understanding and knowledge in the fields of the natural sciences."

The author, Cecil Billington, is an ardent botanist, a genuine nature-lover, and a born teacher. While tramping the fields and woods, we are told, he has made one of the best private herbaria in Michigan. His book contains a beautiful color frontispiece—evidently a shrub in its autumn coloration—, which he credits to Doctor Hatt. This reviewer wishes that a caption had been printed beneath it, for he cannot identify the shrub. There are 161 ex-

cellent line drawings of shrubs made by Thomas Cobbe, and 161 distribution maps. There is a 10-page pictorial glossary of helpful drawings by Mrs. R. T. Hatt. Good workable keys are provided, with simple, clear instruction for their use.

The author has undertaken to define a shrub, and has done fully as well as the dictionaries, but I am sorry that his definition has kept him from including Moonseed, Virgin's Bower, Nightshade Bittersweet, Swamp Loosestrife, Creeping Snowberry, and Dwarf Mistletoe, even though they may be only "a little woody," or "scarcely woody," or "slightly shrubby."

There seem to be no records of the use of the wood of the American Yew (*Taxus canadensis*) for bows by the American Indians. One would hardly expect it to be so used, for, as the author states, it is "a low, straggling evergreen shrub, rarely more than 1 meter high." Apparently there is confusion here with the Western Yew (*Taxus brevifolia*) which was a favorite bow wood among several Indian tribes of the Northwest.

Altogether the book is a fine piece of work in a very attractive format. It should find wide use by all lovers of the outdoors,—both natives of Michigan and those who visit the "Peninsula State."

CLYDE FISHER.

NORTHERN FISHES

With Special Reference to the Upper Mississippi Valley

----- by Samuel Eddy and Thaddeus Surber

The University of Minnesota Press, \$4.00

THIS is an excellent book treating of the fresh-water fishes of Minnesota and adjacent similar areas. It will answer many of the questions asked by the increasingly large number of anglers who find pleasure in wetting their lines in these northern waters.

Some waters are favorable for one species of fish, some for another, and we find a discussion of different types of lakes particularly interesting. "Minnesota lakes suitable for fish can be divided into at least five types according to the species of game fishes for which they are best adapted." These are the lake trout lakes; two types in which walleyes thrive; the bass, crappie, and sunfish lakes; and lastly prairie lakes "largely inhabited by bullheads, buffalo fish, carp, and sometimes by a number of walleyes and other game fishes." Physical characters of the different types of lakes—for example, area, depth, temperature, bottom—are correlated directly, or indirectly through other plant and animal life they support, with the habits of the respective fishes which favor each type. The clear exposition of the factors involved, on a cause and effect basis, gives an excellent idea of the principles underlying any rational attempt to obtain good or better fishing. This subject is gone into at considerable length as fish production and its management, lake and stream improvement.

The major part of the book is devoted to a review by families of the species and

rates of fishes recognized from these waters. There is a chapter on the structure of fishes to enable one to use included keys and short descriptions in their identification. Abundant and excellent illustrations will also be found helpful to that end. Three plates illustrating nineteen species of minnows, and one showing six species of different genera of darters, are especially to be commended—for the numerous small kinds of each are difficult to differentiate.

J. T. N.

THE GREAT SMOKIES AND THE BLUE RIDGE

----- Edited by Roderick Peattie

The Vanguard Press, \$3.75

IT was an excellent idea to make a book about the charming country of the Great Smokies and the Blue Ridge, as Roderick Peattie has done. While he has written only the introduction, he has made a wise selection of writers, who not only had adequate knowledge of their phases of the whole subject but also had the ability to tell the story in an appealing way. Although it has been written with authority, it is a book for the layman, a lover of the out-of-doors. It is believed that many specialists, however, will find it fascinating for the human interest in their own fields and for glimpses of other branches of natural history and of peoples, both the Indian and the white man.

Donald Culross Peattie, lover of these mountains, contributes three chapters to the book, namely, "Indian Days and the Coming of the White Man," "Men, Mountains, and Trees," and "Blue Ridge Wild Flowers," all in his characteristic imaginative style.

The geological story of the region is told for the layman in an interesting, non-technical way by Dr. Henry S. Sharp, Professor of Geology at Barnard College. Alberta Pierson Hannum, who had taught and lived with the Mountain People, has contributed a chapter on these people that reminds one of that fascinating classic, *Our Southern Highlanders*, by Horace Kephart.

"Adventures Among the Mountain Craftsmen" is the title of a chapter by Ralph Erskine, who has for years been making annual visits to this region. His artistic sense gives him a fine appreciation of the varied mountain crafts, and he has also contributed the chapter on the climate with its bearing on hunting and fishing throughout the year. John Jacob Niles, authority on the music of the mountain folk, has written the chapter on folk ballads and carols.

A most valuable section of the book takes you through the seasons month by month and answers the inevitable question, "When should one visit the Great Smokies?" This is written by a dependable naturalist with ability to write, Arthur Stupka, Park Naturalist. The concluding chapter of the book, "How Shall I Plan My Trip?," by Edward S. Drake, provides detailed information on the subject. Altogether it is an attractive volume with many illustrations.

CLYDE FISHER.

ing on Ukerewe Island in Lake Victoria. They were from different litters, for one was much smaller than the other two. Strangely enough one of the latter, though only just caught, disassociated itself from its companions and exhibited an astonishing preference for human society almost from the very first. This threw the other two animals together, for they were bullied by the friendly one, whom we will call A. At feeding times it was customary for A, the strongest of the three, to snap at B and C and drive them from the dish until he had fed to repletion. Should anyone attempt to stroke B or C when A was in the vicinity, he would hurl himself upon the recipient of caresses most viciously. If the lid of their large and roomy traveling cage was lifted, A would leap and squeak or chirp, for he loved to be taken up and petted, to have his ears and armpits rubbed, or his fur stroked backwards or forwards. He might be rolled upon his back, pulled about by the tail, or dragged along by a leg; no indignity could surprise him into an

exhibition of bad temper so far as human beings were concerned.

A fortnight after receiving these mongooses I was camping at Entebbe, Uganda, and allowed them to roam at large—the drop door of their cage being propped up so that they might run back in if alarmed. At Jinja also they were given their liberty for several hours each day. But one could not handle B or C, for they would utter an explosive cry and spring forward with a snap. One good bite upon my finger tip taught me caution so, instead of lifting them back into their cage, I “shepherded them” home when it was desirable to fasten them up for the night.

Before they could again be allowed any liberty, there followed a week of traveling, which included 800 miles by rail. On board ship their cage was placed on the forward hatch, shaded when necessary, and A was allowed out daily. At first the cage was often surrounded by passengers, whose sudden movements proved a source of great alarm to B and C. There were, however, three small boys on board who helped tremendously by playing with the liberated one for hours at a

time. After four days at sea, C was gingerly lifted out. She raced about in enjoyment of such freedom until she was scared by the wind blowing a hat along the deck and fled off the hatchway. I was fetched and after a little maneuvering succeeded in retrieving her. On the morning of the eighth day at sea I lifted out the two tame animals, but as B snapped each time I approached him, I desisted after two attempts. Later in the day I returned and, sitting down beside the cage, tried to rub his ears. To my astonishment he crouched down and, though evidently in great alarm, submitted. After petting him for several minutes I quietly lifted him out of the cage and set him down outside; this was almost the last time that he gave me any trouble.

The trio raced about the hatchway, stretched out in the sun, or rolled over and over as they bit each other in sham fighting. Two coils of wire hawser were selected by them as their headquarters, serving as refuge from both friends and fancied foes. In due course they arrived at their destination and were presented to the Zoological Society of London.

PASSENGER PIGEON

Continued from page 88

as a whole was spread over a period of 40 years.

Once on the decline, all that was necessary to complete the destruction of this bird was the continued cutting of the forests in which it fed and bred, and the destruction of the young about as rapidly as they were produced. We did both of these things, although the killing of the young birds was undoubtedly the greater evil. The squabs were particularly sought by the pigeoners. At many of the nestings almost no young were allowed to go free to become the parent birds of the next year. Such wholesale capture of the young would have brought about extinction of the species even if none of the old birds had been killed.

Nor was any adequate attempt made to protect them by law. In reporting on a game bill which ventured to protect the passenger pigeon

in 1857, a committee of the Ohio State Legislature said: “The Passenger pigeon needs no protection. Wonderfully prolific—no ordinary destruction can lessen them.” The birds killed would not “be missed from the myriads that are yearly produced.” Yet, these same “myriads” were practically all gone by the turn of the century.

So there was nothing mysterious about their going. They were simply driven from their homes and robbed of their food by the cutting of the great forests. They were killed by the millions by the market-hunter armed with net and gun. Their great flocks were scattered and broken, and the survivors were driven hither and thither, helpless targets for shotguns until the inevitable end.

That is the story of the passenger pigeon in its heyday and in its decline and fall. And its going, said the zoologist Hegner, meant that “another of our inexhaustible resources had come to an end.”

LETTERS

Continued from page 53

SIRS:

I greatly miss Mr. Charles Coles's photographic department in *NATURAL HISTORY Magazine* and feel sure many others do. His articles were most interesting and very helpful.

CHANT OWEN.

New Haven, Connecticut.

The articles referred to unfortunately had to be discontinued temporarily when Mr. Coles entered war service.—ED.

* * *

SIRS:

NATURAL HISTORY is my favorite magazine. . . . The articles are wonderful and have been of great interest not only to me but to all my family and friends who have seen the magazine. . . .

FLORENCE V. RHODY.

Riverside, California.

* * *

SIRS:

Yours is one of the finest magazines I have ever had the pleasure to read. I can't get along without it, it is so informative and valuable.

DOROTHY JANE WOBBS.

Oakland, California.



March

NATURAL HISTORY

1944

The Story of Early Mexico • Strategic Drug Plants

Population Problem in the Pacific • African Exhibits

VOLUME LIII, No. 3

FIFTY CENTS

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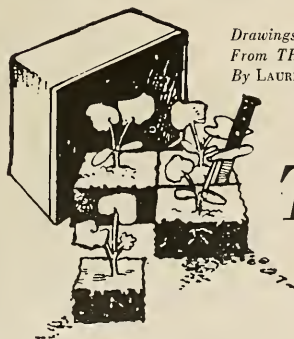
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Drawings by LAURENCE BLAIR
From *THE FOOD GARDEN*
By LAURENCE and EDNA BLAIR
MACMILLAN, 1943

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THE AMERICAN MUSEUM OF NATURAL HISTORY

77th STREET AND CENTRAL PARK WEST, NEW YORK 24, N. Y.

Scientists and Human Beings

NEVER before in the history of our civilization has the voice of science been listened to with such avid attention as it is given today. Never before have its bare facts been so widely and respectfully accepted in the consideration of any problem in human life. Why is it then that so many scientists are still able to feel that the scientific viewpoint is never given a proper hearing in the conduct of human affairs? And why is it that laymen are still able to feel an unsatisfied craving on the richest fare of scientific sense and nonsense that they have ever been offered?

Obviously something must be wrong. Yet only absolute immodesty and total ingratitude could make science complain about the size of the audience or of its willingness to listen for more. Perhaps, therefore, it is something in the manner of listening which makes both speaker and audience dissatisfied and ill at ease with each other.

One must go back to the days of sorcery and primitive witchcraft to find a superstitious idolatry of presumed knowledge equal to that which is bestowed upon science and the scientists in the modern world. When a lawyer speaks of international relations, a banker speaks of art, or an engineer speaks of social problems, it is taken only as the more or less intelligent and more or less well-informed opinion of a private individual whose views are worth hearing and can be discussed in a friendly manner, on the basis of human equality with the opinions of others. When a scientist speaks, the audience does not see the fallible human being behind the words. It hears only the voice of science with a capital S. However modest in intent, the scientist's words become statements *ex cathedra* in the ears of his audience, to be welcomed, feared, or scorned according to the inclinations of the listener, but not to be treated as a simple human contribution to the discussion of human problems.

Forced to be always speaking from the altar of a mysterious knowledge which he humbly recognizes

he has not attained, the scientist becomes wary of expressing himself at all. His intellectual honesty begins to demand that he confine his remarks to the barest statements of fact, since expressions of his own human judgment and opinions will not be accepted simply for what they are. By this withdrawal of the scientific mind from the glare of uncritical public attention, its greatest potential value to society is lost.

Science does not possess any mysterious knowledge which is not available to all alike. Its facts are utterly inadequate to permit it to speak from knowledge on the future evolution of man, or to offer a "scientific" solution in the sense of a proven answer to any of the basic problems of contemporary human affairs. We recognize that civilization is a product of urbanization and could probably not exist without it, but we have no evidence to show whether city life also leads to biological degeneration or to the development of a superior human being. We are barely beginning to discern suitable methods for future scientific study of human relations on a national and international scale.

In short, it is not knowledge which is the scientist's greatest asset. It is his ability, training, and experience in the handling of knowledge and in drawing reasonable conclusions from such meager facts as we all possess. Until man becomes omniscient he can only conduct his affairs according to the best guess he is able to make from his incomplete knowledge and imperfect understanding. There can be little doubt that society would find one of its largest bodies of skilled and highly trained guessers among the scientific professions, if it could only learn to look upon the scientists as ordinary, fallible human beings, and not as the exalted custodians of a mysterious, final, and infallible knowledge, which they must not be allowed to desecrate by being human in their errors and their limitations. The scientists could speak more freely and contribute more fruitfully to human progress if they were less embarrassed by the encouragement of the science worshippers.

A. E. Barr

*Director, The American Museum
of Natural History.*



THERE ARE STILL UNDISCOVERED CONTINENTS

COLUMBUS had a definite goal—a westbound sea route to Asia. But what he found was a new continent—a new source of Nature's wealth.

Modern research also has its goals: it, too, is discovering new resources. Starting from the knowns of science, it charts its voyages into the unknown. Behind each voyage is a theory that there is a passageway.

But research doesn't hold stubbornly to its theories. If it finds islands instead of a continent, it accepts them, for it expects the

unexpected. It studies their relation to the known lands of science. And on the basis of its increased knowledge, it makes revised plans for progress. In science there is always a continent ahead.

Just what research will disclose can never be forecast. But history has proved that from research flow discoveries of value to mankind. From Bell Telephone Laboratories there has poured a full stream of improvements in the telephone art.

Bell Telephone Laboratories has kept America leading the world in

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BELL TELEPHONE SYSTEM

NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ALBERT E. PARR, Director

VOLUME LIII—No. 3

* * * * *

MARCH, 1944

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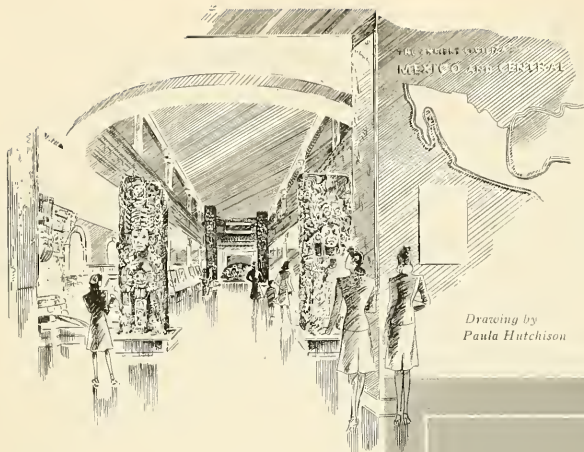
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Drawing by
Paula Hutchison

Treasures from the past dramatically portray the birth and growth of Indian civilization, in the American Museum's new Hall of Mexican and Central American Archaeology

All photos A.M.N.

Middle American Culture on Review

By H. L. SHAPIRO

*Chairman and Curator of Anthropology,
American Museum of Natural History*

SEVENTY years ago the American Museum, soon after its establishment, received its first collection of Mexican antiquities. Twenty years later, largely through the efforts of the Duke of Loubat, this modest beginning had grown into a major collection, requiring an entire hall for its proper housing and exhibition. The 50 years which have elapsed since the dedication of our first hall of Mexican and Central American archaeology have witnessed changes in its location and alterations in its installation. Now we are again celebrating its reopening in a new guise which we owe to the benefaction of one of our trustees. Thus, this Hall which enjoys the dignity of being one of the most venerable in the annals of the Museum is also one of the most vigorous and vital, adapting itself to contemporary demands and reorganizing its content to fit the advances of archaeological scholarship and research. This capacity of a great and complex institution to discharge its intellectual duty by keeping its exhibits abreast of modern knowledge augurs well for its future.

The hall which we are now opening for the public represents an epitome of a great civilization whose seat lay within the area of Central America and Mexico. In the centuries preceding the arrival of Columbus and Cortez, this civilization developed and flourished now in one part of the region, now in another. But these diverse expressions, distinguished as they were by their local genius, were nevertheless united and sustained by a common tradition that reached back into the antiquity of the region. Just as we differentiate various phases of Western Civilization geographically and historically, recognizing the cultural

distinctions as well as the cultural unities of English, French, Italian, and Spanish art, so it is possible to think of Maya, Toltec, Aztec, and Zapotec as local developments of a basic community. This common heritage never received a name; it has none now, largely because the historical connections which establish its unity have only recently been discovered.

Although scholars are still debating the precise antiquity of man in the New World, there is little doubt that the Indian immigrants on their arrival in the Western Hemisphere were endowed with only a primitive stone culture. Indeed, they probably entered this continent via the Bering Straits at a time when no civilization had yet developed in the Old World. The most they can be said to have brought with them were the mere rudiments out of which a civilization might be forged. These primitive hunters and wanderers, moving south into the empty New World, gradually occu-

pied and settled it out of their own increase. In certain places they achieved an agriculture and a sedentary life, made possible by the development of peaceful arts. In two or three areas at most these settled forms of life evolved into authentic civilizations. One of these was Middle America, where from native sources a civilization arose that reached heights comparing favorably with the achievements of many of the great traditions of the Old World.

Thus the prehistoric civilization of Mexico and Central America, insulated from the civilizations of the Old World, contributed nothing to them and received nothing from them. It was born from a primitive fragment of the Old World, and it developed in continental isolation, cut off by vast seas and great stretches of continent from all contact with the active cen-

➤ THIS SEATED CLAY FIGURE from Vera Cruz represents a local style that flourished in pre-Columbian times



ters of civilization in Europe or Asia. This segregation of the centers of New World culture from the currents of Old World civilizations confers upon them a special significance in the panorama of human experience. It means that here in prehistoric America new and independent experiments in civilization were developing and unfolding in their own fashion and according to their own patterns.

Under these circumstances it is to be expected that the great civilizations of the New World would exhibit fea-

tures peculiar to themselves and that the idiom of their expression would offer some impediments to those accustomed to the dialects of other cultural traditions. There is, indubitably, much in the arts and customs of the civilized Indians of pre-Columbian Mexico and Central America that is foreign, not to say downright repulsive, to our sensibilities attuned to other canons of esthetics and behavior. The grotesque funerary urns of Oaxaca with their crowded symbolic decoration certainly ring no bell for

our conditioned reflexes. The abhorrence of the Mayan artist for broad undecorated spaces and his itch to fill every nook and cranny of his monuments with figures and designs seem foreign to our satisfaction in the balance and relief of emptiness. To our eye, trained, at least until recently, to delight in the perfection of natural proportions, the apparent disregard of the Mexican artist for realism may interfere at first with our appreciation of his skill in detail. In fact, the preoccupation of our esthetic tradition with the human body and the glorification of its sensuous aspects is completely lacking in pre-Columbian art, which, on the contrary, tends to treat the body as an element in a design.

These characteristics illustrate the differences which motivated the artists of the New World as against those of the Old. They explain perhaps why, although pre-Columbian masterpieces have been known to European collectors for more than 400 years, they have been prized during this time only for their rarity, their technical finish, or their value to scholarship.

One might reasonably ask why it has taken us so long to recognize the virtues of Mexican art, if indeed they are as transcendent as we are coming to believe. The answer, I think, lies not in the deficiencies of the art but in the eye of the observer. Mexican art had the misfortune of first coming to the notice of Europe when cultivated Europeans were thoroughly possessed by the classic tradition. Indeed, I think I am safe in asserting that the art of Mexico was the first great esthetic tradition outside the familiar Mediterranean pattern to challenge the prejudices of modern Europeans who were unable by education, training, and conviction to accept readily the beauty of an exotic artistic medium. Only after European taste had become flexible and receptive by acquaintance with the Chinese, the Hindu, and the African idioms, not to speak of the newly discovered products of long-forgotten Old World cultures, was it ready to appreciate the neglected riches of prehistoric America.

But aside from esthetic experiences, Middle American civilization also offers a record of the evolution of culture that is pertinent to the understanding of civilization wherever it arises. Although the archaeological history of Middle America is still fragmentary, one can already discern the outlines of its growth. We know

▼ THE SO-CALLED STONE YOKE OCCURS in various parts of Middle America. It was not, however, worn on the neck or shoulders; neither did it serve to link its wearer to anything. Prehistoric sculptures show individuals wearing stone objects like these

around the waist and resting on the hips. Presumably they were worn during a special kind of ball game. Many of them are plain or decorated with simple motifs. This one from Vera Cruz is exceptionally ornate, with its intricate design in high relief





▲ THE ENDS of some of the stone yokes are beautifully carved. This shows the end of a Totonac yoke embel-

lished with a human head topped with a design element that appears repeatedly on the body of the yoke

that man existed in this region for millennia, probably as a simple hunter. Gradually he developed an agriculture based upon native American plants. At the beginning of the Christian era well-established civilizations were in their full creative vigor, constructing temples for their highly organized re-

ligious systems, decorating them with sophisticated art, and producing the manifold amenities of civilized life. We have records of the development and decline of whole civilizations, such as the Maya, which yield evidence on the factors and conditions that shape the destiny of a culture.

From the same sources we can trace the influence of one culture upon another and thus add to our appreciation of culture dynamics. These results, still tentative and partial, may eventually contribute profoundly to our understanding of the problems of culture growth.

▼ THE AZTECS were relatively late arrivals in the pageant of Mexican history. They invaded Tenochtitlan, the modern Mexico City, and established themselves there as conquerors. Although much of their sculpture is crude and unappealing to our taste, they occasionally reveal in a piece like this an amazingly subtle use of stone. The simplicity of pose and the smoothness of detail combine to lend a charming dignity to the Corn Goddess represented here

► SOMETHING of the same character that is discernible in the Corn Goddess reappears in this additional example of Aztec stone sculpture. It was found in the Valley of Mexico. The ancient artists of Mexico paid little or no attention to the accurate representation of body proportions. They elide detail and frequently distort an anatomical feature, yet they achieve a harmonious and integrated whole



In unfolding such an archaeological progress of a civilization, one of the primary necessities is a chronological frame of reference—a series of events on a time scale. This fundamental obligation has preoccupied the attention of archaeologists for a generation or more. They have struggled to define the characteristics of each phase of Middle American culture and have been gradually tying them into a chronological pattern by which they can relate each phase of culture growth to all others in the area. The difficulties of such a task are inconceivably complicated and require much hard, patient, and often tedious work.

In the absence of historical records, the archaeologist by necessity has had to develop a method of extracting information from the excavated rubble of the past. The rewards come as the recovered pieces of information fall into their allotted places and add another brick to the slowly rising edifice of reconstructed knowledge. The Museum may justly take pride in the pioneering role it has played in this achievement. The chronological sequences which are displayed in this

► THIS EFFIGY VESSEL was made by a Huasteca potter from the northeastern coast of Mexico. It is from a period late in local archaeology. Painted details add verisimilitude to the figure and emphasize the slight modeling

exhibition hall for the first time are in a large measure the result of excavations and research by scholars from this institution.

As one contemplates the various aspects of the civilization we have been discussing, one cannot, I think, avoid a profound sense of that community of striving that everywhere characterized mankind. For here, in this exotic culture, with all its peculiarities of style, the by-products of the human spirit are basically like our own. It is impressive that without knowledge of the developed arts and of the achievements of the Old World, these pre-Columbian civilizers, these craftsmen and artists, created them afresh. The search for economic stability and fairly constant sources of food led here as elsewhere to the discovery of agricultural techniques, which in turn permitted the assemblage of population in cities and towns. By virtue of these concentrations of people, specialization of labor was made possible and technical skills emerged in indepen-



▲ PALMATE STONES such as this are found in the vicinity of Vera Cruz and are attributed to the Totonac people, who developed an extraordinary art. The figure has been identified as a wild turkey

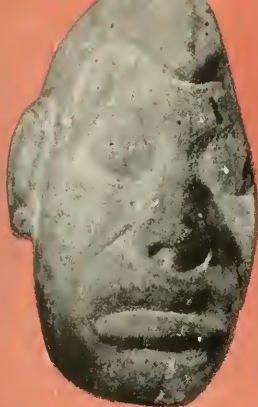
dent but familiar patterns. The complexities of social organization and control found tentative solutions here that echo those known to us in the Old World. Here in Mexico and Central America was evolved an original and noble architecture, designed to house the gods and the rites of organized religions. The ineffable need for artistic outlets found esthetic expressions in painting, sculpture, and in-

numerable minor arts. The craving of man for an ordered and accepted body of knowledge and belief found comfort here, too, in a native lore vested in the priesthood. The members of this body observed eclipses and other natural phenomena, developed an original calendar, invented the zero before it was known to Europeans, and recorded much of their knowledge and history in a written language which has only been partially deciphered. These are only a few of the developments of civilization which the natives of Middle America were able to achieve by their own efforts. But they are enough to illustrate the solid advances for which they were responsible and to confirm the extraordinary parallelism between their road to civilization and the familiar avenues of the Old World.

The installations in the Hall of Mexican and Central American Archaeology have been designed to serve two interests: the general and the specific. In two rows of cases flanking the central aisle of the Hall, in the wall cases at either end and in the foyer of the Hall, we have installed the treasures of our collections. That does not mean that your individual taste might not prefer some piece tucked away in a less prominent position. In fact, we expect that your explorations will uncover much of distinction outside the special cases. But it was our intention to place prominently a selection of fine representative pieces which might serve to give the visitor a general impression of the art of the region without distracting him with analyses. Here is an abundant range of styles and objects; some of them heavily marked by local convention, others possessing a universal quality rising above time and place.

In a series of alcoves along one side and elsewhere in the Hall, we have





◀ THIS HEAD of fine-grained granite probably belongs to the Vera Cruz tradition

➤ THIS BEAUTIFULLY INCISED STONE DISC may have been the back of an iron pyrites mirror. The clean detail, the conventionalization, and the nice balance of the design combine to make it an exceptional example of prehistoric Mexican art. It is from southeastern Mexico



▶ THIS POTTERY JAR was found at San Jacinto, Salvador, and belongs in the great period of Maya art. The painting is polychrome. The human figure rarely occurs as a graphic element in pottery decoration elsewhere in Middle America



arranged exhibits for more specific interest. Here, various regional cultures are defined and the time sequences analyzed and characterized. These we hope will prove invaluable for students studying the history of the region and for the casual visitor whose fancy has been captured by the more general exhibits.

It will not be out of place, I think, to mention briefly the technical problems of the Hall itself. It has long been an ardent wish of the Department of Anthropology to house its splendid Mexican and Central American collections in a setting worthy of their exceptional character. At various times ambitious and elaborate plans and models were created toward that goal, but inexpediency or, more realistically, lack of funds prevented the accomplishment of these projects. Meanwhile, it was felt something must be done at once, even if the ideal were impossible and the times seemed unpropitious. That decision was reached a year ago. One of the trustees, who prefers to be nameless but whose devotion to this Hall is well known, generously provided the necessary support, and the administration approved the plans. Since this is a period of priorities and of rationed material, our garment was necessarily cut to fit the cloth. Although we have been handicapped by these shortages, the results achieved have well justified the effort.



◀ THE MAYAS of Yucatán were noted for their stone work. The intricacy of design and the abhorrence of empty spaces were characteristic of the Maya style. This was originally one of a pair of door jambs in a temple at Kabah, Yucatán. It was collected by Stephens a century ago and is now at the American Museum

▲ MORE COMMONLY than figure painting the pre-Columbian potter employed abstract designs such as this in embellishing his products. This vase is in the Cholula style

► A PAIR of pottery figures from Colima, Mexico. The achondroplastic dwarf appears to have been a favorite subject of the Colima potters. This type of chunky dog also occurs frequently



We have used simple means; we have broken here and there with Museum traditions in decor; we have completely reinstalled the entire Hall. To those familiar with the older embodiment of it this newer garb will, I think, seem revolutionary. We hope all of you will enjoy it, but we present it to you not as the ultimate Hall, not as the most imposing, but rather as a tentative creation which in the future may be replaced by a more perfect one.

So many hands and so many minds have co-operated to produce the final result that it is a matter of considerable satisfaction to me to point out that this has been a truly joint enterprise. We have profited from the suggestions and criticisms arising from the various members of the Staff, from the Director down. To all of these we are indebted. The general burden, however, of planning the Hall and of devising the exhibits has fallen upon Dr. Gordon F. Ekholm, Assistant Curator in Mexican Archaeology and Mr. Clarence L. Hay, Research Associate in the Department of Anthropology. Their unswerving devotion, their erudition, and their enthusiasm are fittingly embodied in the Hall. To Mr. Victor Ronfeldt, Mr. Joseph Guerry, Mr. Paul Richard, and to Miss Kay Beneker upon whose taste and skill we have leaned heavily, the execution of the installations is largely due.

▼ THE FAMOUS COLLECTION of Copán sculptures housed in the American Museum are here shown in part in their new setting. These pieces originally were fixed in temple walls by means of long tenons protruding from the back. For many students, Maya art reaches its apogee in these classic examples of stone work





▲ THIS GROUP of small pottery figurines from Nayarit and Jalisco, Mexico, illustrates the plastic character that the Mexican modeler was able to impart with a simplified technique

► IN THIS SECTION of the case containing the stone sculptures of Vera Cruz and neighboring areas may be seen something of the variety of expression characteristic of the prehistoric artists. The two padlock-like specimens at the bottom are unusual. Their use is unknown

▼ THE STONE WORK of Costa Rica occupies a rather special position in Middle American art. The style is distinctive and easily recognized. Particularly characteristic are the metates, or grinding stones, in the shape of four-legged animals.



➤ ARCHITECTURE in Mexico and Central America developed as one of the major arts. Its characteristics are quite distinct from Old World construction. The sub-structures or platforms were an integral part of the whole and often attained enormous size. The temple itself was approached by means of a long steep flight of steps, and was more in the nature of an altar than a place of assemblage. This perhaps led to the use of the outside walls of the temple for elaborate decoration. The model shown here is the Casa Colorado (Red House) at Chichen Itzá, Yucatán. The internal construction of the building is made clear by the section of its walls



▲ THIS CASE on the left as one enters the newly designed Hall contains pottery figures, pottery vessels, and stone sculptures from western Mexico. These figures offer a wide range of human interest when seen in actual size, since they represent a variety of activities and dress



◀ THESE STONE OBJECTS, all from Vera Cruz, include a palmate stone, two stone yokes, and an incised stone disc. Their exceptional artistic merit becomes evident in their new installation

THE GLORY BEFORE

FEW areas are as important in the history of the New World as the Valley of Mexico. It is a small inland basin almost completely surrounded by high mountains and situated in the high central plateau of Mexico. For the last 400 years it has formed a setting for the great and beautiful city of Mexico, first as a capital of New Spain and then as a capital and focal point for all events of importance in the modern Republic of Mexico. All of this has been, however, only the second great period in the total history of this important valley. The first and earlier period was brought to a close by the most colorful and dramatic episode in the European conquest of the New World—the conquest of the Aztec capital of Tenochtitlán by Cortez in 1521. The first period lasted for nearly 2000 years and is the era during which the Valley of

Mexico was an important center of a developing Indian civilization.

Certain aspects of the history of this long prequest period are what concern us here. It is a history which is only very sketchily known and which can never be fully known because of the limitations inherent in the nature of archaeological records. There are a few written historical documents that contain limited but important information concerning certain events in the later portion of this long period, but it cannot be hoped that they will in any way serve to interpret events of earlier times. For the most part lost in the obscurity of the past, this history of prequest times is, nevertheless, one of the most fascinating epochs in the history of the Valley of Mexico. It is the story of the rise of the American Indian from a plane of relatively simple agricultural life to an advanced

and highly complex civilization.

History derived through the methods of archaeology becomes not an account of political events or of the rise and fall of important personages, such as our modern histories present, but an account of what is well defined by the term "cultural history." The archaeologist must deal with those material

FOR THE FIRST TIME in a public exhibition the history of the Valley of Mexico is told in four chapters with their chronological subdivisions. The new display also shows the various sorts of material from which the scientist determines the cultural sequence, and it interprets the people's way of life from the relics they have left behind.

The alcove at right represents the first known period in the Valley of Mexico. Already there is settled community life, based chiefly on agricultural pursuits. This is called the Middle Culture Period because it is midway between an early stage of agricultural life (as yet undiscovered here) and the elaborate ceremonial cultures of the later periods

▼ THE MOST CHARACTERISTIC OBJECTS from the Middle Culture are small clay figurines, which probably had some religious or magical purpose. All are handmade, unlike those from molds in later periods. Variations in the style of Mexican figurines make them invaluable in determining cultural sequence. Those below represent the later of two subperiods into which the Middle Culture Period is divided



CORTEZ

By GORDON F. EKHOLM

*Assistant Curator of Anthropology,
American Museum of Natural History*

New methods in exhibition technique climax the archaeologist's patient reconstruction of Mexico's past—and buried ages come to life

All photos A.M.N.H.



▲ THE MAP SHOWS the principal places in the vicinity of Mexico City that have yielded important material from the earliest culture displayed in this chronological exhibit. Lake Texcoco is seen to have shrunk since the days when these localities were close to its shores



▲ THE VIEWER is brought closer to the actual problems the archaeologist faces in the field by photographs like the one above showing how the treasures of the past are excavated

objects which, because of their durability or through some fortuitous circumstance, are preserved through the centuries. Above all, then, he reads the history of the development of arts and crafts and the changes that have occurred in their techniques or styles of manufacture. From these objects certain other cultural phenomena can be deduced, such as the size of communities or the nature and importance of religion. Migrations of groups of people or the influences of one culture on another also become apparent, as well as periods of cultural growth and decline.

In the archaeological history of any area certain major events are usually apparent, such as the intrusion of new peoples or a break in the uniformity of cultural evolution. Events like these permit a division of the total history into a sequence of cultural periods.

In what we know of the cultural history of the Valley of Mexico, four principal periods are usually recognized. The culture of each period is in many ways distinct from that of the others, a fact which can readily be seen when the objects found by the archaeologist have been arranged in their proper order. This has been done and forms an important feature of the newly installed exhibits in the Hall of Mexican and Central American Archaeology in the American Museum

of Natural History. Four alcoves have been used to outline the cultural history of the Valley of Mexico. Each of the alcoves is devoted to one of the

periods in the sequence and is designed to show as much as possible of the cultural characteristics of that period. The forms of architecture, the pottery,

the sculpture, and all the other kinds of objects characteristic of each period are exhibited. In other words we have attempted to illustrate the cultural



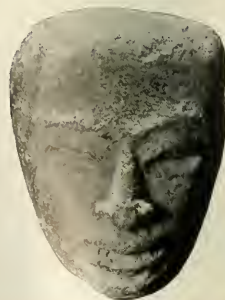
▲ THE SECOND PERIOD is divided into five stages, best seen in the figurines, which are

displayed in evolutionary sequence. The oldest subperiod is represented at the bottom

1 SUBPERIOD I. During this stage the heads of the figurines are characteristically small. The fashioning of the eyes is particularly useful in identifying them. The eyes are made by applying a small oval fillet and cutting it horizontally with a groove. The faces are prognathic, that is, the jaws project beyond the normal

2 SUBPERIOD II. The most characteristic feature is again the eyes. But though they are slitlike, they are made in the surface of the face and not in superimposed fillets

3 SUBPERIOD III. The most common type at Teotihuacan is this "portrait type." The modeling is naturalistic, and there is no ornamentation. Figurines from this period are easily recognized by their simplicity and realism



history of the Valley of Mexico with the actual objects that have been used by the archaeologist in interpreting it.

The known sequence of the Valley of Mexico cultures is based largely on stratigraphic excavation. The principle behind this all-important method of interpreting cultural history is simple and can be reviewed in a very few words. It is based simply on the fact that succeeding peoples living at any one place will leave layers of cultural debris and that the remains of the later occupation will lie above those of the earlier. The archaeologist attempts to separate the remains of the several layers, and, if he is successful, he has a record of the kinds of objects manufactured during different periods of occupation.

But while the principles of stratigraphic research are basically simple, the use of the method becomes an exceedingly complex and intricate undertaking. The debris of human occupation is seldom laid down in orderly layers, and when it is, it often later becomes mixed and confused through such things as the digging of graves or the construction of buildings, or perchance by natural agencies. Furthermore, it happens only rarely that deep deposits of debris are found in a single excavation or at a single site wherein a complete sequence of cultures can be seen. The stratified materials from one site must be carefully



All photos A.M.N.H.

▲ MEXICO'S GREAT PYRAMIDS of the Sun and the Moon dominate the site of Teotihuacan, center of culture during the Second Period in the Valley. The Sun Pyramid, measuring 693 feet on a side and 211 feet high, is shown in photographs just under the map. The ceremonial aspects of the Mexican culture are in full development during this Period

4 SUBPERIOD IV. Here the faces are realistic as in the previous subperiod, but there is the addition of simple headdresses and ear plugs. In this period all of the figurines are made in molds instead of being fashioned individually by hand



5 SUBPERIOD V. At this stage, ornamentation has become complex and is a very important part of the figure. Certain gods common in later periods in the Valley of Mexico can be recognized, such as the Rain God, Tlaloc, shown here. He can be recognized by the heavy rings around his eyes



compared with those from other sites, the entire sequence for the area being patched together or built up from bits of evidence from various excavations at a number of sites. Stratigraphic research is, therefore, not as easy in practice as it might appear to be. The techniques which have been evolved by the archaeologist in his attempt to read an orderly history in the material remains of ancient peoples have become a highly involved process of detection, which would require a long explanation to describe adequately.

Because of the difficulties inherent in the archaeological reconstruction of history and the amount of time and work necessary to completely study the remains of even a small area, most of the results remain to a large extent tentative. The exhibit of the cultural sequence which has been installed in the Mexican and Central American Hall is, for instance, far from complete and final. Innumerable details have yet to be filled in, and it is even possible that the principal division into four periods may have to be changed or other periods added. The exhibit is actually only a synthesis of what is known up to the present moment and must not be considered an established and unquestioned structure. Nor is the division of the cultures of the Valley of Mexico into what appear to be very sharply defined periods a true reflection of what actually occurred. This seemingly sharp division is partially due to the necessity of simplifying the exhibit and partially to the incomplete studies of transitions which occurred between the major culture periods in the Valley of Mexico.

Of particular importance to the history of the Valley of Mexico is the relatively large amount of documentary or, in a sense, truly historical information available on the preconquest cultures. The Aztecs may be said to have been "historically minded," for at the time of the Spanish conquest they were able to give a legendary account of a long line of chiefs and of important events involving themselves and earlier peoples in the Valley. These legendary accounts are reinforced by a few historical accounts recorded in hieroglyphic writing by the Aztecs themselves in their own books or "codices." Of equal importance, however, was the lucky circumstance that a number of Europeans who came as conquerors or shortly thereafter were sufficiently interested

in Indian life and history to preserve for us comparatively full accounts of Aztec customs and to record their legendary histories. Most of this historical documentation concerns events in the last or Aztec Period, but some extends back as far as the Toltec Period. All of it is extremely valuable, especially when used to supplement archaeological findings.

Only very recently a particularly confusing aspect of the history of the Valley of Mexico has been clarified through the combined use of both documentary and archaeological sources. It has shown that the Toltec Period played an important part in the sequence of Mexican cultures. Actually the confusion that existed for a great many years resulted from a misinterpretation of documentary history and a lack of archaeological work at certain strategic sites. The legendary accounts of the Aztecs refer to the Toltecs as the people who preceded them in Central Mexico and who had the reputation of being master builders and craftsmen. They speak of the Toltecs as the group who introduced many of the arts into central Mexico and as the builders of a great city which was known as Tula. Until recently it was generally assumed that this Tula was the great ceremonial center of Teotihuacán. The Toltecs were, therefore, thought to have been the carriers of the Teotihuacán culture. It is also stated explicitly in a number of the legendary accounts that it was the Toltecs who migrated to far distant Yucatán and built the great city of Chichen Itzá. That something was wrong with this interpretation was apparent, however, in the fact that none of the typical elements of Teotihuacán culture were ever found to occur at Chichen Itzá. The necessity for a more literal acceptance of the legendary accounts was stressed by several Mexican historians, for they found that the Tula of the chronicles could clearly be identified with the modern town of Tula in the state of Hidalgo, a short distance north of Mexico City. With this lead from the historians, excavations were begun by the Mexican Government in the ruins at Tula, and extremely significant discoveries were made. It was found that many elements of the culture at Tula were very similar to those of Chichen Itzá, just as the legends had indicated.

These studies have shown that an important cultural development occurred in Central Mexico between

the end of the Teotihuacán Period and the beginning of the Aztec Period. This has been one of the most important contributions of recent years toward the clarification of the cultural history of the Valley of Mexico and of Mexican and Central American archaeology as a whole.

We have been speaking here of the archaeological history of the Valley of Mexico as if it were a bit of local history reconstructed entirely through investigations in the Valley of Mexico alone. Actually, however, that is far from the case. The progress of historical reconstruction in any one small area like the Valley of Mexico depends to a large extent on the progress of archaeological research in a great many other areas and, in fact, on our gradually increasing knowledge of American Indian history as a whole. We have already alluded to one of the most outstanding examples of the interdependence of work in one area with that in another at a considerable geographic distance—the basic similarity of the culture of Tula with that of the Mexican Period at Chichen Itzá. In this case, work in either area very directly supplements the work in the other.

The dates we have given to the four cultural periods in the cultural sequence of the Valley of Mexico are only approximate, but what accuracy they have depends in large measure on the success that has been attained in reading the calendric inscriptions of the Maya monuments in Southern Mexico and Central America. Through similarities between objects occurring in a known part of the sequence in the Valley of Mexico and those of a certain period in the Maya area it has been possible, in part at least, to extend the Maya chronology to the Valley of Mexico. Stratigraphic excavations in any part of Mexico or Central America or, in fact, anywhere in the New World, have some direct or indirect bearing upon the historical reconstruction of the Valley of Mexico.

It must be apparent, then, that what we know of any cultural sequence such as that of the Valley of Mexico is only part of a vast mosaic puzzle which at the present time is only partially complete. The completion of the mosaic in any one part affects the possible completion of all other parts. Certain portions of this puzzle that are more important than others or have been worked more intensively provide a key which serves to simplify the remainder.

► VARIOUS PERSONS are seen making offerings at what appear to be temples in this important wall painting in the "Temple of Agriculture" at Teotihuacan. Here the art of fresco paintings reached a high degree of development. This example, like some others recently discovered at Teotihuacan, are notable for their naturalism. The figures are not cluttered with ceremonial equipment and symbols as they are in most examples of Middle American art



▼ TYPICAL POTTERY STYLES of the Teotihuacan Period are shown in this exhibit in the third alcove. Pottery of this period is highly distinctive both in form and finish. Most characteristic are the cylindrical vases (middle right)

A.M.N.H. photos



The Valley of Mexico is certainly one of the key areas. The chronological exhibits in the New Hall of Mexican and Central American Archaeology, some of which are shown on these pages, are designed to give the public a concise and illuminating view of this important phase of the history of the Western Hemisphere. In conjunction with related exhibits they will serve further to elucidate the ever-increasing knowledge of American Indian cultures as a whole.

▼ THE THIRD ALCOVE describes the Toltec Period, the third in the cultural sequence of the Valley of Mexico. The most important site of this Period is Tula, about 50 miles north of Mexico City. This site is now being excavated by the Mexican Government, and scenes from it are shown in various photographs. The archaeologist spans distance as well as time, and discoveries like those at Tula heighten the fascination of his work. Aztec legend told how the people of Tula migrated to Chichen Itzá, a now famous archaeological site almost 1000 miles away on the Yucatán peninsula. Excavation at both places proved the legends true and revealed the cultural relationships in detail

Photos by A.M.N.H. unless otherwise specified





Photo by Alex Krieger

▲ AT TULA these great figures, approximately 15 feet high, formerly stood on top of the pyramid and supported a roof. The figures are made up of four sections, held together by pin and socket

▼ THE INNER SURFACE of the wall surrounding the Temple of the Moon bears this design. It shows a serpent devouring a human skull and represents the god Tlahuizcalpantecuhli

Photo by Alex Krieger



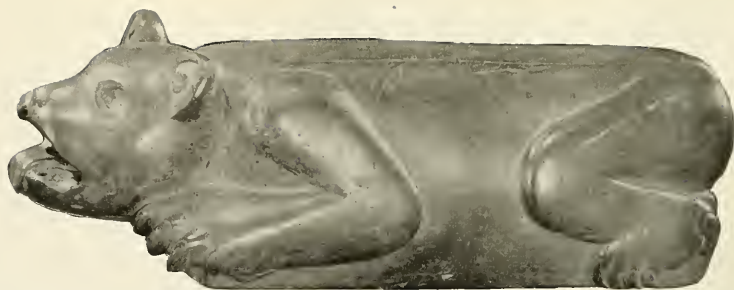
► A LARGE CLAY HEAD of the Toltec Period, of a type thought to represent a person wearing flayed human skin, thus symbolizing the god Xipe-Totec. (Found at San Francisco Mazapan)

▼ THE PYRAMID or Temple of the Moon at Tula. This, like all the other buildings at Tula, was destroyed in prehistoric times. The sculptures in the foreground formerly stood on top, but the people who destroyed the city made a cut in the pyramid and dropped them down. The white fretwork is on a wall surrounding the pyramid



Photo by Alex Krieger



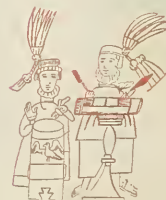


◀ "CARTOONS" of a serious nature contribute much toward an understanding of the life and times of the Aztec Period. These are found in books, or "codices," one of which extends in a long strip across the back of the case below. The examples reproduced here show various musical instruments in use at the time

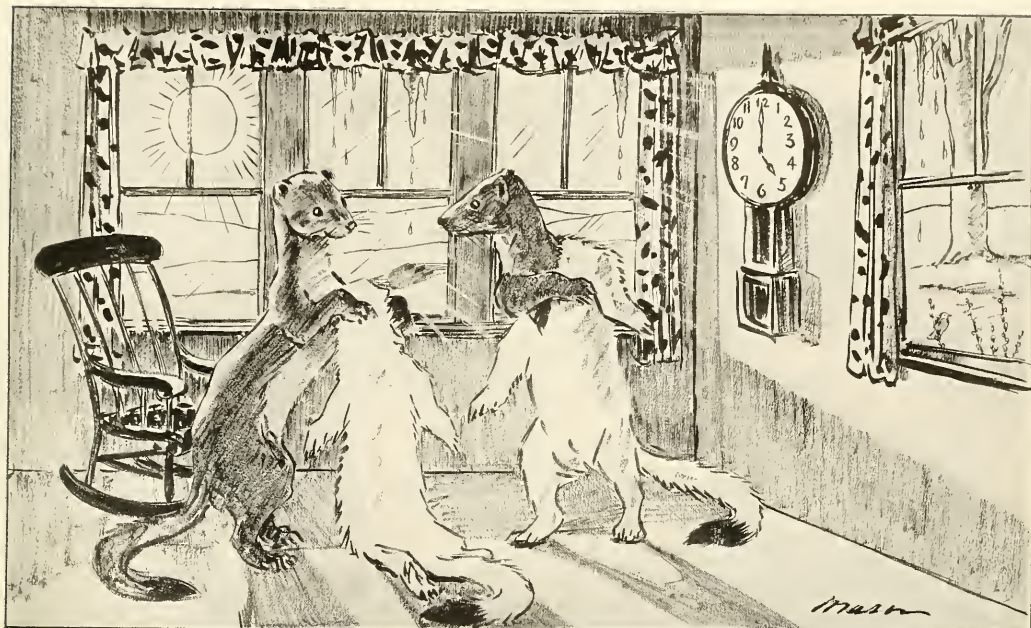
▲ THIS FINELY CARVED WOODEN DRUM is exhibited among other instruments illustrating the musical arts of the Aztecs. The chipped stone tools exhibited in the case are a reminder that the Aztecs attained a high artistic level without the use of hard metal tools

▼ THE FOURTH or Aztec Period carries the story down to Spanish times. When Cortez came in 1521, the Aztecs were the dominant people of Mexico. They had conquered much of central and southern Mexico. Tribute of all kinds flowed into their capital city at Tenochtitlan. Aztec culture was made up of various elements received from cultures in other areas and from previous periods in the Valley of Mexico

A.M.N.H. photos



NEW SPRING OUTFIT



By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON

Even the royal ermine becomes dull brown in spring

“CAN the Ethiopian change his skin or the leopard his spots?” asked the ancient poet. They do not, of course, but in lands where snow covers the ground in winter and melts with the increasing warmth in springtime, a number of mammals and some birds change color strikingly. The process of turning white in autumn and becoming brownish or grayish again in spring is accomplished by shedding the old feathers or hairs and growing new ones of a different color. Even when their coats remain the same hue throughout the year most mammals shed and renew their hairy coats spring and fall. This and the change of color are both known to be caused by the increase in the length of the daylight hours and by nothing else, at least in northern latitudes.

Until this was discovered a number of ideas were held about the cause of the strange seasonal color change. Perhaps the commonest theory was that cold weather caused the animals to grow winter coats, just as it prompts

us to get out our heavy woolens, and that warmth was the cause of the spring molt. Unfortunately most animals begin to change before the temperature does. And if you make it cooler for an animal in summer and warmer in winter, the change in color takes place just the same.

Some fishes and lizards and the tree toads change color—and rapidly. When placed on a light surface they become pale; on a green leaf or in the eelgrass they may become green. These changes are known to be caused by what these animals see. Some observers naturally thought, therefore, that seeing snow or brown earth affected the color of birds and mammals too. In these creatures, however, coloration is chiefly in the feathers and hairs, dead structures rather than live cells like the color-bearing cells of the other vertebrates.

Varying hares and ermine do not turn white just through being kept in a white room. Food has little to do with color in most cases, although proper diet has a lot to do with the health of hair.

If changeable mammals are kept in a constant temperature during the summer but exposed to gradually decreasing periods of light, they turn white. If, after a while, the light periods are gradually increased, the same animals turn brown again, even though it is only January. Animals kept under the same conditions but given the normal seasonal light, go through the reverse cycle, as they would living in the wild. Weasels¹ can be put through as many as two cycles in a single year instead of the usual one cycle, quite without regard to season.

Willow ptarmigan² of the Arctic and timberline tundras, when kept under these conditions, respond to the light in the same way that the mammals do and molt out of season. Some of these birds were kept outdoors in the snow, and when the winter daylight was lengthened artificially they turned brown, getting their spring plumage months before the other birds.

¹ Bissonnette, T. H., 1943. *Transactions N. Y. Acad. Sci.*, vol. 5, pp. 43-51.

² Höst, Per, 1942. *The Auk*, vol. 59, pp. 388-403.

The destruction of native life and culture in Micronesia, begun three centuries ago when white civilization invaded the islands, approaches the critical stage under Japanese mandate

By WILLARD PRICE*

THE Pacific has been the ocean of the brown man. It is now becoming the ocean of the yellow man. And that yellow man is Japanese.

Are we destined soon to look out upon a Japanese Pacific?

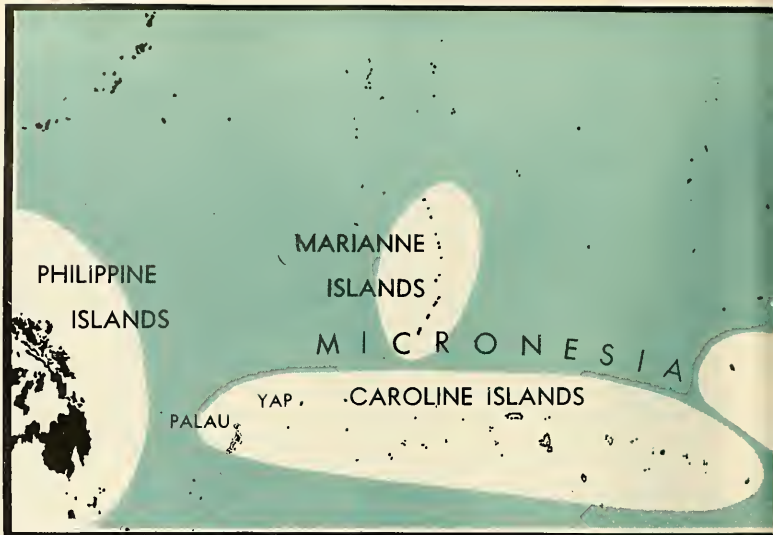
The islands over a large area may after the war be owned by British, Americans, the Netherlands, or the United Nations in common, but the population will be increasingly Japanese if the trend of the last quarter-century continues.

In our own Hawaii there are 160,000 Japanese; even if no more are admitted, their high birth rate will make them before long the majority in the population of Hawaii.

And much more rapid is the Japanese increase in islands directly under Japanese control. These islands now number some 10,000 including the 7083 of the Philippines, the 1400 of Micronesia, and the many other groups.

I stood upon a hilltop in Palau, one of the secret islands of Japan's Pacific mandate which white men have rarely succeeded in visiting since Japan seized the great island-world of Micronesia in World War I. Beside me was a native king, and we were looking at a Japanese ship in the harbor. It had arrived the day before, from Yokohama.

"Two hundred Japanese came on that ship," said the king, whose kingly rule had long since been suppressed by the Japanese. "On every ship they come. And those who are here have



Will the Pacific be BR

many children. It is the beginning of the end for us."

"Why shouldn't the native and the Japanese live side by side?" I asked.

"Because these islands are small. Their resources are few. Not enough for a large population. What little there is will be taken by the Japanese."

Below us lay a busy sprawling town where there had been nothing but jungle a few years before. Taxicabs honked through the streets. Paper banners advertising sales floated from Japanese stores. Japanese geta (wooden clogs) clattered along the pavements. Radio towers pierced the blue sky. It might have been a bit of Yokohama itself.

You had to remind yourself that you were in the South Seas. It was necessary to look hard among the people below to find a brown man.

"My people all die," the king lamented. "Long time ago, only old men died. Now young men die."

Of course the Japanese are not solely responsible. They have merely accelerated a process already begun by white men—whalers and traders and adventurers—who forced their attentions upon the islanders of the Pacific and left with them their diseases and vices and not many of their virtues.

The native population of the Solomons has shrunk to one-fourth its for-

mer size. That of the Marquesas to one-tenth.

There were 100,000 brown men in the Marianas when the foreigner came; now there are 7000.

Before the Germans took the Marshalls in 1885 the native inhabitants numbered 15,000. The number has dropped by a third.

There is one native in Sonsorol for every two twenty years ago.

When the first American whalers came roistering ashore on Kusaie they found 2000 natives, but the number had dwindled to 200 before the end of the Spanish regime.

The 13,000 people of Yap in early Spanish times have left only 4000 successors.

When Cook discovered the Sandwich Islands (Hawaii) in 1779 the native population was estimated at 300,000. In 1941 there were 14,000 Hawaiians left and 52,000 part-Hawaiians.

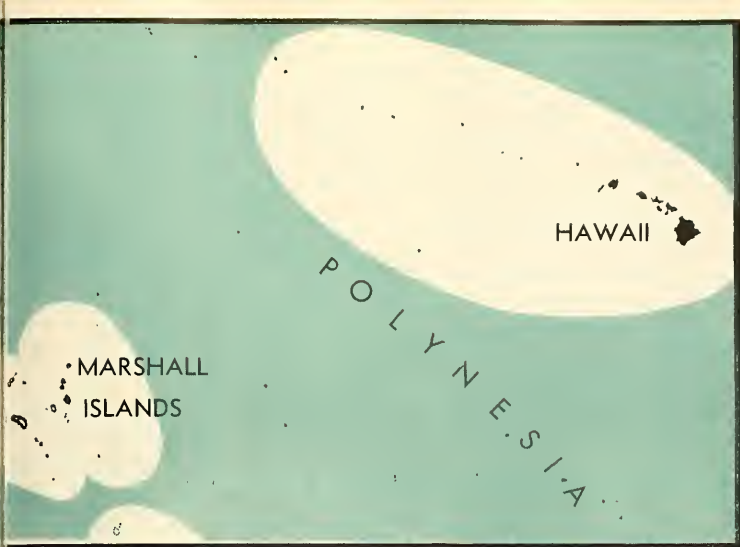
A native poet of Tahiti, looking upon the decay of his race, lamented:

The leaves are falling on the sand,
The sea shall swallow coral strand,
Our folk shall vanish from the land.

As Charles Darwin points out in *The Descent of Man*, sudden civilization spells death.

Primitive man is not so adaptable as his civilized brother. His life has a

*WILLARD PRICE has previously contributed to NATURAL HISTORY Magazine on subjects from the Pacific area and is one of the few white men to have penetrated Micronesia since the Japanese made it their own in 1914 and barred foreigners. His new book on Micronesia, *Japan's Islands of Mystery*, will appear this spring.—Ed.



BROWN or YELLOW?

simple pattern. If he is suddenly thrown into the complex currents of modern life the result may be disastrous. Civilized men, Darwin says correctly, are stronger than savages. By the variety of their lives, they have developed physical immunity to many diseases and mental immunity which enables them to stand up to new ideas without flinching.

If civilization is worth anything it should make the human race better, not poorer—and it has done so. But sudden exposure of the savage to the intense light of modern progress is as disastrous as an overdose of a sulfa drug.

To be fair to ourselves, it should be said that we, white men and yellow, are not wholly to blame for the disappearance of the native. His habits have not always been conducive to longevity.

To drink the water in which a dead chief has been bathed does *not* impart to you his moral qualities, but his infections. A fever patient should not be plunged into the sea. The waving of a wizard's wand cannot knit a broken rib. Heavily thatched huts as dark as a pocket inside are breeding pens for tuberculosis.

But they were not until the tuberculosis came.

"We Japanese bring our tuberculosis into Micronesia," admitted Doc-

tor Sekine of the Yap hospital. "The disease is old in Japan. There we often carry it without succumbing to it. But the natives are virgin soil for it and can't resist."

The Japanese have built hospitals and schools for the natives. But what they give the native with one hand they take away with the other. For every well-meaning doctor there are dozens of Japanese adventurers whose only aim is to get rich at the expense of the "kanakas."

The average Japanese executive is not of high caliber. He resents having been exiled to the islands. The restraint of homeland customs being removed, he is likely to drink more than is good for him and his inhibitions are loosened. Under pressure from carpetbaggers who have invaded the islands in search of easy money, he milks the natives dry for benefit of his friends.

There is no place in the new economy for the brown man, except as a wage-slave. And Japan even sends in wage-slaves of her own to replace him.

All industries are in the hands of

► A NATIVE CHIEF of the island of Yap wears a comb to indicate nobility. Slaves may not wear combs



THESE STONES on Tinian, in the Marianne Islands, are relics of a vanished people. Their function is unknown, although they resemble similar monoliths found in association with religious ceremonies in other parts of Oceania. The natives of this and other Pacific Islands will follow their prehistoric predecessors if their population continues to decline



▲ A YOUNG KANAKA BOY. Judging from the stains on his teeth, he has already begun to chew a little betel nut





◀ KING JOHN with some of his 13 children and 46 grandchildren. One way to retain power as a king is to be the father of a good part of the population

▼ A KANAKA GIRL poses with her pet pig. She wears a special cord to indicate that she is of marriageable age. Her teeth are already stained black from chewing betel nut. Note the scars on her arm, presumably from vaccination against small pox, which came to the islands along with western civilization



▼ A KANAKA shakes out lime onto a betel nut laid on a leaf preparatory to betel-chewing. Chewing the betel nut is unknown in the eastern Micronesian islands, but is common here in the western ones where the Malay influence is strong



Japanese. A native so unwisely enterprising as to start a shop or factory would soon find difficulty in getting supplies or machinery. His shipments would be unaccountably damaged in transit. When affairs had reached a fairly desperate stage, a Japanese business man would appear with an offer to buy his outfit for perhaps a tenth of what it was worth. If he was prudent, he would accept with alacrity.

If he stood on his "rights," his place might be destroyed some night by thugs or a fire. If he protested to the authorities, he might be branded as disloyal and subjected to "questioning"—the Japanese euphemism for torture.

"It doesn't pay to make trouble," say the natives.

It must be said that such treatment is not reserved for the natives. Unlucky Japanese are as summarily treated by the *kempeitai*, Japanese gестапо. The forcing of "confessions" from innocent persons is an art as highly developed in Japan as the tea ceremony. But the Japanese can hope for justice in the courts. The Micronesian cannot.

"The Japanese don't pay," said a native baker. "I used to be a sailor. I learned to bake on an English ship. After I came home and the Japanese came I thought here was a good chance to bake bread—some of the Japanese like it. So I got a little store and some ovens. The Japanese liked my bread but would not pay me for it. So I went out of business.

"Then I tried being a contractor. There was a great demand for labor. So I would get men to work for the Japanese. I would have to pay the men—but the Japanese wouldn't pay me. So again I had to quit. I won't try again. It's no use."

Wage scales differ sharply for the chosen people and the subject race.

The Japanese carpenter or shipwright receives four yen a day; the native one or two.

The net result of a policy of banishing disease and teaching industry, but at the same time depriving the people of the fruits of either health or industry, is an accelerated decline of the native population, while the Japanese population soars.

In all the 1400 islands of the Marianas, Carolines, and Marshalls, comprising the great Japanese mandate stretching from near Japan to the equator, there were in 1914 perhaps 300 Japanese. By the time the mandate was confirmed by the Versailles Conference in 1919 the number had risen to 3000. It climbed steadily to 56,496 in 1936, outstripping the native population of 50,000.

But worse was yet to come. A Five-Year-Plan of immigration was begun in 1936. It brought the Japanese population up to 62,305 in 1937 and 73,028 in 1939. This is the last year for which figures are obtainable. If the rate of increase of these years has been maintained (and there is every reason to believe it has been, since the war has undoubtedly brought many civilians as well as garrisons to the Micronesian bases), the Japanese population of the mandated islands stands in 1944 at approximately 100,000.

In the meantime the native population, which had so long held its own at 50,000, sagged, perhaps under the terrific pressure of the Japanese flood, and by 1939 had dropped to 40,406.

Thus in a single generation the natives, who by immemorial tenure might have been supposed to have a right to all the elbow-room their small islands afforded, were overrun by an alien population more than twice as large as their own.

Immigration did not do all this. Indeed, if immigration were stopped tomorrow, the situation would continue to grow progressively more acute. A rapid increase of Japanese would take place even without immigration.

The Japanese birth rate is one of the highest in the world. The native Micronesian birth rate is one of the lowest. In 1934 Japanese births in the islands were 1714 and deaths 475, the natural increase being 1239. Native births were 1562 and deaths 1637, causing a natural decrease of 75. As noted above, that decrease has since been greatly accelerated.

Japan's rapid settlement of Pacific islands has been a matter of concern to all nations surrounding that ocean. Spain first held the islands, but her tenure worried no one. By the time Spain reached her fingers all the way around Asia there was very little strength left in the fingers. Germany bought the islands from Spain, but they were too far from Germany to be dangerously used.

When Japan took the islands, the whole situation changed. Japan was in a position to use them. There had been no German immigration to the islands. An old resident on Palau remembers that there were fifteen Germans there (three officials, five priests, five sisters, and two traders). Today there are an estimated 15,000 Japanese. Then, in all these islands, there

were not more than 100 Germans; now, 100,000 Japanese.

That is the difference. Japan took the islands seriously. Spain and Germany never did.

United Nations victory will not settle the problem. The question will remain: shall the Japanese occupants of the islands be allowed to stay? Many of them are innocent farmers, fishermen, and business men. It is too bad to have to rout them out of their homes. But it is likely they will have to pay the penalty for their nation's rape of Asia.

Japanese infiltration would not stop with Micronesia. Even before the war Japanese were multiplying in the islands of Australasia and Polynesia. There were 25,000 Japanese in the Philippines. Davao, in the Philippine island of Mindanao, was a tropical Tokyo. Japanese were pouring into the Netherlands islands, despite restrictions. We were surprised to learn that steamship fare from Japanese Palau to Dutch Celebes was half rate.

"Why?" we asked the ticket agent in Palau.

"Our Government has decided that Celebes is a good place for Japanese."

The Government subsidizes the steamship line. Therefore, when the Government orders that the fare to Celebes shall be cut in half to encourage Japanese colonists to go there, the line obeys.

The war, of course, immeasurably quickened Japan's economic infiltration into the former Dutch and Australian islands. Japanese workers by the thousands have poured in to man the oil wells and war industries, open shops, and accelerate trade. Japanese bosses run the plantations. The Japanese are working their way into the warp and woof of daily economic life.

They have had a taste of the riches of these lands. They have learned how to develop their resources. They will leave no stone unturned in their effort after the war to dominate Asia economically. And we, for our part, have no wish to prevent legitimate economic development. How to be fair to Japanese trade, and at the same time keep the Pacific from becoming a yellow man's ocean to the complete extinction of the brown and the exclusion of the white, may well rack the brains of postwar administrators of liberated lands.

The Japanese talk of a hundred-year war. By that they mean that the decision in the present war, even if against them, will not stop their program of expansion.

They even have schools of expansion in their great cities—where prospective emigrants are prepared for life in the South Seas.

I met a graduate in Truk.

"When do you intend to go back to Japan?" I asked him.

▼ A YOUNG KANAKA GIRL. The grass skirts sometimes weigh 30 pounds. They really include three skirts, one on top of another, one worn to bed, two about the house, and three when stepping out. They are sometimes of grass, sometimes of pandanus

▼ BUILDING A BIRD SNARE on the island of Yap, due east of the Philippines. Gum from the breadfruit tree is wound around a stick which is fastened just below papayas, bananas, or other fruit. Birds interested in the fruit alight on the stick, cannot reach the fruit, and cannot escape

▼ THIS OLD CHIEF of Palau blows on a shell, a Triton's horn, to call the men to the council house





▲ SOME OF THE MEN of Truk do a native dance. This little-known island, which is the hub of Japan's interisland defense system, has recently made the front page of newspapers throughout the world



▲ SPEARING FISH in a lagoon on Palau. Like most island people, the Micronesians depend upon the sea for much of their food



▲ THE YAP CANOE is made of a single log, hollowed out and shaped. The lateen sail is made of pandanus leaves. Note the outrigger on the far side



◀ MAKING A CANOE in Palau. Like the Polynesians, the Micronesians have acquired a great deal of maritime skill



➤ A "DRINKING FOUNTAIN" in Palau, where rain is the only fresh water. To collect the rain water which streams down the trunk of the tree, a palmleaf conduit is made to carry it into the jar. Most modern houses have iron roofs from which rain water is collected in a cement tank

"Oh, I won't go back. You see, I've been trained for Truk."

"But you'll have to go back some day to find a wife—unless you take a brown girl."

"No brown girl, please," he laughed. "No, I get my wife from the brides' school. She is coming now—arrive next week."

"Have you ever seen her?"

"Oh no, certainly, no."

"Then how do you know she will suit you?"

"Oh, that is very safe. You see, I send all my thoughts [he meant characteristics]. The president of the school, he picks a girl with the same thoughts. So everything very happy."

The brides' school in Tokyo trains girls to become the wives of colonists. Men who have gone to the islands write back for mates.

Where the Jap goes he expects to stay. He does not interbreed with the natives, whether they be Polynesians or Californians. He establishes a little Japan. This generalization needs to be qualified by the admission that there are many sons or grandsons of Japanese immigrants in the United States who are loyal Americans. But in general the Japanese are more cohesive and exclusive than any other people.

Let them become numerically dominant in any island or country and they will expect ultimately to become politically dominant as well. Therefore, we cannot countenance their becoming the most numerous element in the islands of the Pacific unless we are prepared to see these islands become and remain a part of Japan.

Whether the United Nations will make any attempt to solve this riddle remains to be seen. Would an enforced migration of South Sea Japanese back to their homeland be in order? The few hundred thousand in the entire Pacific could easily be accommodated in Hokkaido, where there is a population of only two and a half million but capacity, according to Japanese authorities themselves, for 20 million.

That is a political problem. The ethnological one is that the essentially fine Polynesian people, capable of great development if the development is slow enough, is being rushed out of existence by a too-rapidly multiplying race of chauvinists taught that it is their divine duty to occupy and possess in the name of a God-Emporer not only the Pacific but the world.



▲ ABOARD THE *Palao Maru*, bringing 200 Japanese immigrants to the mandated islands. In 1919 there were 300 Japanese here; by 1939, 73,028. If the rate of increase has been maintained since 1939, there are probably 100,000 Japanese in Micronesia



▼ AFTER FOUR YEARS of this in the school gardens and on the Government's experimental farms, the natives return to their villages with seeds, tools, and a fairly durable willingness to work. Some of these boys have had their hair shaved off like Japanese school boys



▲ NATIVES help build houses for the thousands of Japanese immigrants who have been streaming into the islands of Micronesia, many of which became Japanese mandates after World War I



➤ A NATIVE OF YAP paints a house built as a model by a Japanese carpenter

◀ A JAPANESE POLICEMAN enters his new home, a Government-built Japanese house far away in the jungle of Yap. He will have to be a combination of guide, father, teacher, and doctor to the natives. A sewing machine, symbol of western civilization, is being carried into the house. Notice the woman wearing geta on her feet and carrying her child on her back in typical Japanese style



▲ NATIVES work hard under conditions of forced labor in the phosphate mines of Angaur in the Palau Islands



▲ THE PHOSPHATE DEPOSITS on Angaur Island. Native laborers are impressed into service and receive only a fraction of the pay of Japanese workers for the same work



▲ A WOMAN of Yap offers shell money for bottles of petroleum from the Chamorro trader. A string of this length is worth about 20 cents. Note the large disk of stone displayed outside the house



◀ DRESSED FOR A DANCE on Ponape, or Ascension Island, in the Carolines



▲ A STIRRING WAR SONG. The girls are tapping out the rhythm with sticks on wood



◀ A COOL COSTUME for tennis. The natives appear to have adopted some of the white man's games but not many of his clothes

➤ IN YAP'S PORT-TOWN, the Kanaka youth "wears" a necklace and a bicycle. Like the bicycles that Japanese boys ride, this has handle-bar brakes, not coaster brakes





▲ THE LITTLE GERMAN BOY (the son of a missionary) is only two, while the little Palau girl is four—yet they are the same size.



► THIS NATIVE GIRL does not ordinarily wear the grass skirt but has put it on for the visitors. She is the wife of a Japanese, who might object to her dressing like this. Most Japanese settlers bring wives from the home country. Around her neck is a piece of Palau money said to be worth \$300

► THE MODERN COMPETITOR of the native wizard is the Japanese physician—but physicians and hospitals are few and are not found on the remote islands



▼ RADIO TOWERS, electric light poles, Japanese stores, Japanese bicycles, and Japanese costumes are seen where at the time of World War I there was nothing but jungle with an occasional native dwelling like the thatch house on the right. The signs on the little shop at the right inform us that tobacco and Sakura Beer are on sale inside



▼ A GOVERNMENT LAUNCH brings Japanese officials on visit to a jungle outpost



Round Trip to



Africa

THE traditions of the American people are rooted in the wilderness, the covered wagon, the open road, the horizon beyond the horizon. Today they are thinking of yesterday's journey and tomorrow's promise.

Not long ago in one of the large halls in The American Museum an elderly lady was seen sitting before a group of lions portrayed in their natural setting, exactly as in life. She was studying the scene intently.

At that moment a scientist happened to pass. With what sounded to him like superiority, she remarked, "I have traveled all over the world."

The scientist had, as he puts it, traveled only far enough to pick up a few old bones. He was taken aback at her apparent challenge and wondered how far he might be expected to compete in the conversation.

"All over the world," the lady continued, glancing back through the Museum, "—and all for a five-cent subway fare."

Akeley African Hall, from which a few additional pictures are shown here, is an exact replica of the African wilderness and its wildlife, reconstructed in the heart of New York.

Airplanes are now flying over many of the jungles and deserts shown in its 28 alcoves. Every one who knows the men who are flying the planes is more interested in these vistas than before. And when it is impossible for one on the home front to travel any farther than the subway will take him, the artistry of these exhibits may provide some inspiration and a vision beyond.

◀ **LEOPARDS** are found throughout Africa and most of southern Asia, in many types of country but oftenest in bushland and forest border. An angered leopard is a dangerous opponent for an unarmed man. The animal hunts by stealth, creeping close to the unsuspecting victim and then rushing swiftly to seize the prey. The long canine teeth bite into the head or neck. Bush pigs are a favorite prey in East Africa



A.M.N.H. photos

▲ **THE CHEETAH**, or hunting leopard, is spotted something like a leopard but is not closely related to it. Its claws, unlike those of other cats, are blunt and are not protected by a fold of skin when not in use. Cheetahs usually hunt in pairs and secure their prey by running them down. They are said to reach a speed of about 70 miles an hour, but tire after half a mile. They are about the size of leopards and unlike most wild cats are easily tamed

▼ **A YOUNG MANDRILL**: an animal of the west African rain forest. The adult male, with his brilliant colors, is the most bizarre of the baboon-like monkeys. The female (*seen in the photograph*) is only half as large and lacks the bright color on the muzzle. The master of the mandrill troop may have 10 or 15 consorts, and the band may include 40 individuals. The young males are not tolerated after adolescence. Leopards are the mandrill's only enemy outside of man





▲ VAST HERDS of antelope covered the dry plains of South Africa when white settlers first came. The group above includes three important types. The springbok (*left*) is notable for its habit of leaping extremely high into the air when in flight. It can also erect the crest of white hair on the back in a conspicuous fashion. The white-tailed gnu

(*center*) is unusual in appearance, with its brush of hair above the nostrils and a horselike mane and tail. The blesbok (*right*) is marked by a blaze of white on the face. Like its relatives the topi and the hartebeests, it is high at the shoulders and long-headed

▼ HYENAS, jackals, and vultures make up the clean-up squad on Africa's tree-dotted plains. Here the carrion eaters have assembled to consume the remnants of a feast left by lions. The marabou

stork, seen behind the tree, is unable to tear off bits of meat, but when a piece is available it often pushes in and seizes it



► THE KLIPSPRINGER (literally a "cliff springer") is a specialized rock antelope, distinguished from other African antelopes by its coarse, pithy hair and narrow cylindrical hoofs, on the tips of which it stands. It is found wherever there are suitable rocky hills, in southern and eastern Africa. This is the East African Klipspringer (*Oreotragus oreotragus schillingsi*)

A.M.N.H. photos

▼ A POINTED upper lip used for grasping leaves and twigs and two extraordinary horns make the black rhinoceros one of the strangest looking animals of Africa. The black is the most common rhinoceros throughout most of Africa south of Abyssinia and the Congo. The rhinoceros sees poorly with his small beady eyes and has to depend more on the sense of smell.



Strategic DRUG PLANTS

Just as important in war-time as guncotton and life belts are the gifts of the plant world that heal and lighten suffering

By HAROLD N. MOLDENKE

IN a war torn and bleeding world, wherein men since the dawn of recorded history seem continually to insist on inflicting pain and suffering on their fellow men, countless thousands of souls give thanks today for the soothing and healing arts of medicine. One by one the diseases are being brought under control by patient medical scientists. Often remedies for our afflictions and draughts to soothe our pain are found hidden by nature in common wild herbs and trees about us. Primitive natives have frequently discovered the beneficial values of wild plants, and in some cases hitherto completely unknown and unsuspected values have been found in certain plants quite by accident.

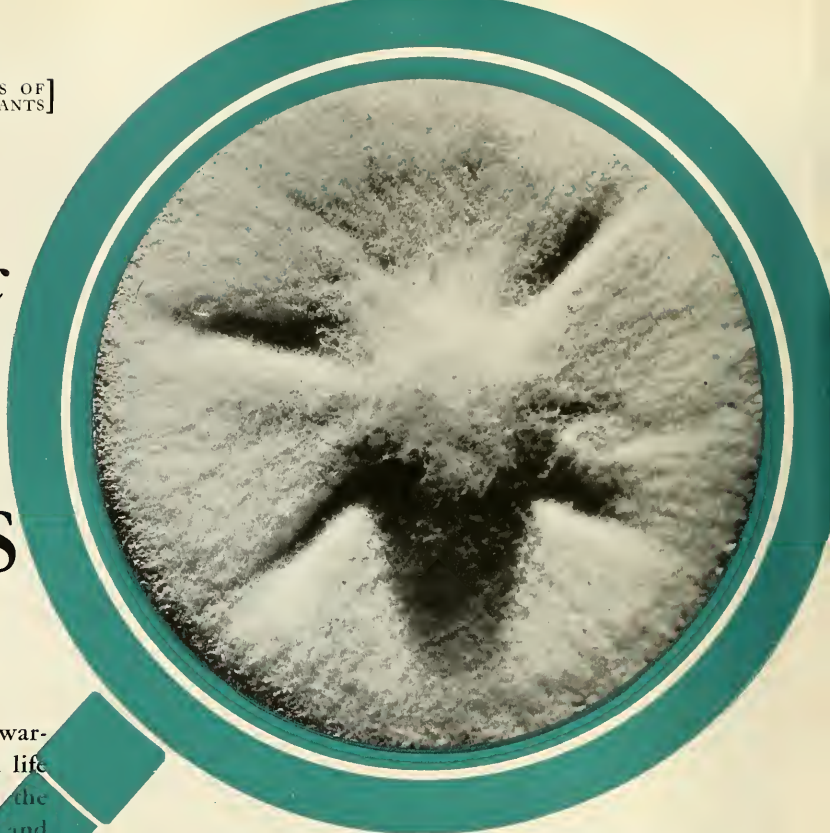
Unquestionably the most spectacular discovery along this line in recent years has been that of penicillin. It has been aptly termed a "miracle drug" and promises to become a very impor-

tant ally in helping wounded soldiers fight their way back to health. A few years ago the mold from which penicillin is derived was considered only a nuisance in biological laboratories. Its innumerable spores, floating around on dust, got into things that laboratory workers were trying to keep sterile, or germ-free. It is similar to the mold that grows on Roquefort cheese. We are not in the habit of looking charitably on mold, but now that penicillin has emerged as a sort of "Cinderella" among drugs, we are going to have to change our attitude. Penicillin is recognized as the most powerful germ-killing substance known to science.

More potent than the sulfonamides or "sulfa drugs," which themselves are almost miraculous in their effects, penicillin also shows promise in preventing gas gangrene and clearing up other infections in wounds. It is successful in treating infections due to the presence of *Staphylococcus aureus*. This is the germ responsible for boils and abscesses, acute and chronic osteo-

myelitis or bone infections, cellulitis or inflammation of connective tissue, carbuncles, empyema of the chest, and, rarely, a type of pneumonia. Much more clinical work must of course be done on many of these conditions before the worth of penicillin can be completely determined. It has also been successfully used for wounds and burns complicated by infections of this germ, even where the critical stage of bacteremia (generalized infection of the blood stream) has set in. All this comes as especially welcome news because the sulfonamide drugs are more useful against the streptococcus germs and are of relatively limited value against staphylococcus infections. Examined microscopically, streptococci resemble little strings of beads, while staphylococci look like bunches of grapes.

Penicillin was discovered accidentally in 1929 by Dr. Alexander Fleming, when he noticed the unusual absence of bacterial contaminations in cultures of the greenish-blue mold



Boury photos from Three Lions

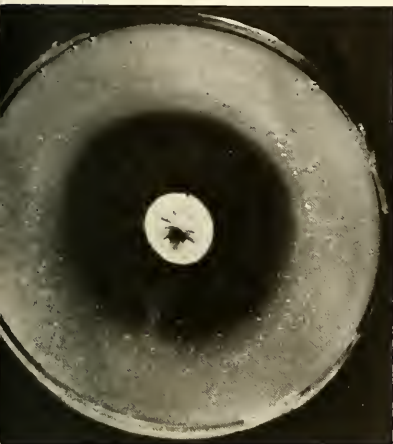
▲ FACE TO FACE with penicillin, the "miracle drug"; a microscopic view of the mold that produces the most powerful germ-killing substance known to science

known as *Penicillium notatum*, Penicillin is manufactured by the mold in carrying out its own processes of growth and is obtained from the culture medium on which the mold has been grown. The solutions yield only about 1 ounce of the substance from 500 quarts of the medium. Different

strains of the mold give different yields of penicillin, so high-yielding strains are being developed. Many substances besides penicillin are in the culture medium fluid, and unless some of these are removed they produce toxic effects. Careful purification is therefore necessary. Furthermore, while penicillin is a powerful agent for killing some bacteria, it is much less deadly to others of the same variety, and if the solution containing the penicillin becomes infected with these resistant bacteria they produce some factor that robs the penicillin of its germ-killing power.

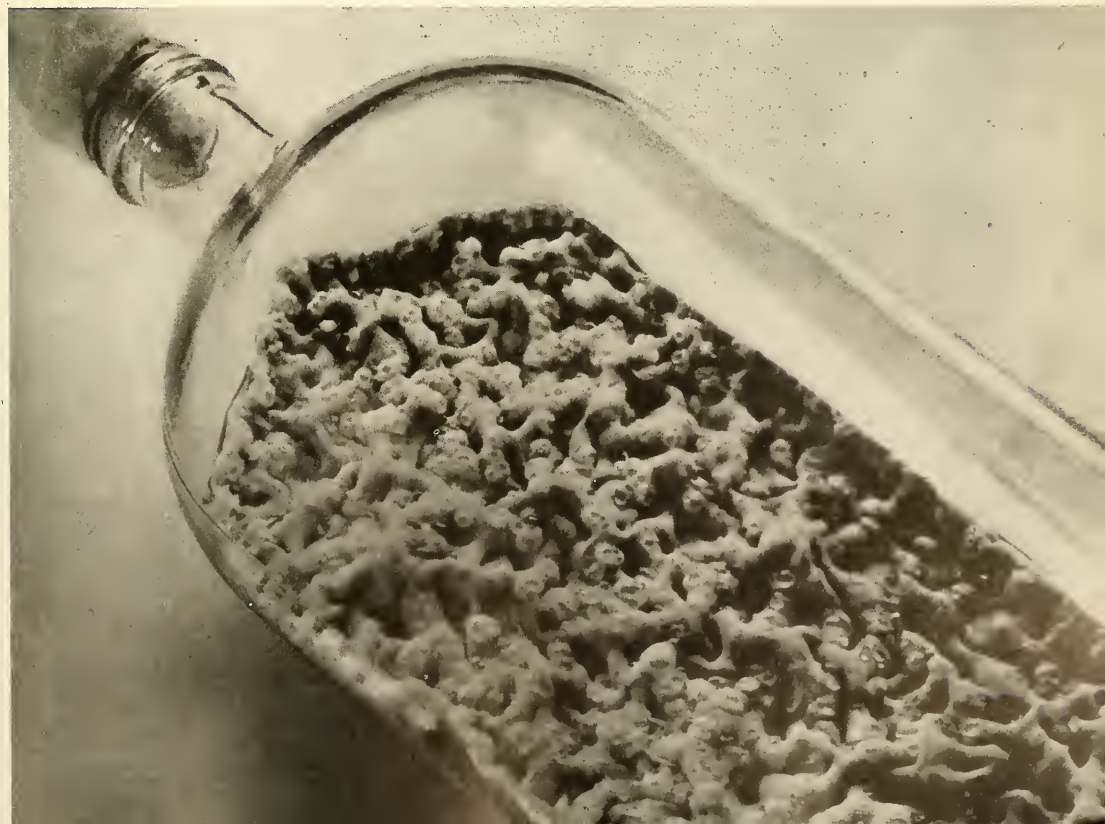
It is therefore necessary to keep all solutions in a sterile condition.

The great potency of penicillin may be gauged by the fact that cultures of some germs have been killed in three hours by a solution of penicillin as dilute as one part in two million! When used in treating human beings, the amount of penicillin employed is measured in milligrams, and there are 28,350 milligrams in an ounce. It has been found extremely valuable in treating gonorrhea. The few developed cases of this disease that had proved entirely resistant to sulfa drugs were



◀ How the valuable drug was discovered: a culture dish showing the power of the mold to establish a germ-free halo around itself in the midst of dangerous bacteria. The mold was formerly a nuisance in the bacteriological laboratory because its countless spores, floating in the air, contaminated cultures. When Dr. Alexander Fleming happened to observe that bacteria died in the neighborhood of the greenish-blue mold, the new drug was discovered

▼ BORN of a lowly form of plant life that is frequently associated with ideas of decay, the "Cinderella drug" obliges us to change our attitude toward molds. The process of deriving penicillin from the growing mold is difficult and costly, but a bright new victory in man's war against disease is in the making



▼ **BELLADONNA** served to beautify the eyes of the belles of old Italy. Today eye specialists use certain forms of it in examinations because of its power to paralyze the adjustment mechanism and dilate the pupil. Belladonna plants of different sizes are here shown to be produced by seeds from different regions. They were cultivated experimentally at the Bureau of Plant Industry Station at Beltsville, Maryland



cured in from 17 to 48 hours. Experts say that penicillin compares with other antiseptics as radium compares with other minerals. Unlike the sulfa drugs, it is not toxic to man, even in strong doses.

It will probably be a long time before chemists are able to synthesize penicillin in their laboratories, since its structure is as yet unknown. About 12 days' growing time and plenty of laboratory space are required to produce a gram of the precious substance, but this amount is sufficient for about 20 standard doses. Penicillin holds so much promise for working near-miracles in war medicine that its development is being facilitated by the Office of Scientific Research and De-



Photos by Bureau of Plant Industry, U.S.D.A.

▲ **WITH** new scientific problems constantly confronting the world at war, the Bureau of Plant Industry works diligently to adapt vital plants to new uses and new regions: a scene of the Bureau's drug and condiment specimen garden at Beltsville, Maryland

lated to penicillin are *clavacin* (from *Aspergillus clavatus*) and *fumigacin* (from *A. fumigatus*). These are both potent germ-killers, but are fairly toxic to animals. Time will tell whether they can be used in the treatment of human beings. The present shortage of penicillin results from the difficulty in extracting it from the mold. Methods of growing the mold are slow and costly. We are still in the stage that we were in when vitamins had to be extracted from plants and it required a carload of oranges to produce a tiny amount of vitamin C. When chemists learned to make synthetic vitamin C, the price dropped from \$213 to less than \$2 an ounce.

Not as spectacular, perhaps, but equally strategic is the little potato-relative known as belladonna or deadly nightshade (*Atropa belladonna*). From the leaves and roots of this plant and some other nightshades is extracted the poisonous white alkaloid, atropine. Eye specialists use certain forms of it extensively in examinations, because it paralyzes the adjustment mechanism of the eye and dilates the pupil. The belles of old Italy were familiar with this dilating property and used it to give their eyes a more alluring luster, whence the specific name, belladonna ("beautiful wo-

velopment and by the National Research Council. Almost all available supplies are reserved for the armed forces and can be released for civilian use only by special permission in extreme emergencies. It does not destroy any of the red or white blood cells, as sulfonamides occasionally do. It doesn't cause fever or rash.

Penicillin may prove to be the first of a whole series of similar substances capable of fighting disease germs. Two have already been prepared from other molds. Thus the history of penicillin promises to parallel that of the sulfa drugs, of which five are in general world-wide use, several more on the verge of general adoption, and at least 2000 under study. The new drugs re-

man"). Other powerful drugs besides atropine are derived from this source, but space does not permit discussion of the various ways in which they have been used in medicine.

The belladonna plant is native to Europe and Asia. America's supplies were formerly imported from central Europe. Now some 200 farmers are growing it on about 500 acres in Wisconsin, Pennsylvania, Ohio, Virginia, Tennessee, and some other states. Although it is a new crop in this country, the yields are good and the quality is satisfactory. On an average the alkaloid content of the crude drug is almost twice the United States Pharmacopoeia standard. It requires about the same processing as tobacco, and indications are that supplies of this essential drug will be adequate for both military and civilian needs. Thanks to the foresight of the botanists of the Bureau of Plant Industry, seeds have been distributed to growers in tobacco-producing areas so that their barns and other drying equipment can be used for drying the belladonna in wet seasons. The plant is a branching leafy perennial with shiny black berries that are about half an inch in diameter.

From South America comes another

▼ A HOMELY PLANT that has gone to war a second time: peat moss or sphagnum, whose natural disinfecting properties and absorptive power have made it valuable in the dressing of wounds

Photo by Kosti Ruohomaa from Black Star



drug plant, *Cephaelis ipecacuanha*—the source of ipecac. This plant is a member of the Madder Family, with creeping stems and drooping flowers. A tincture from the dried roots and rhizomes is used as an expectorant and emetic. Imports of this drug from Central and South America more than doubled between 1938 and 1940, rising to 150,000 pounds annually.

Before the fall of Singapore the British had made considerable progress toward cultivating ipecac on extensive plantations in Malaya. Now the wild jungles of tropical America offer the only source of this life-saving medicine. It grows only in regions where the rainfall ranges between 60 and 80 inches annually and where the deep moist soil has a high humus content and a clay subsoil. It therefore is found in roughly the same regions in tropical America as the rubber trees, *Hevea* and *Castilla*.

Ipecac was used for centuries by South American Indians and was introduced into Europe in 1672 by a French doctor, who for many years carefully guarded his secret cure. Many a wailing infant has been quieted by a dose of this super-action stomach-pump. The gathering is simple. The plant is pruned by the roots, usually in the dry season, with sharp-pointed sticks. The roots are then dried in the sun, broken, packed into bags, and baled for export. Sufficient roots are usually left in the ground to produce a new plant. Under cultivation ipecac is slow-growing and requires two to four years to reach marketable size. Three to four ounces of the dried drug are obtained from a mature plant. The botanical source of ipecac was not known until 1800. Originally most of the drug came from the Diamantine region of Brazil; now it is obtained also from Nicaragua, Honduras, Costa Rica, and Panama.

One of the most recent and important substitutes for true ipecac is *cocillana*, derived from *Guarea rusbyi*, a native of Bolivia and Peru. This important tree was discovered in Bolivia in 1896 by a New York botanist and plant-hunter, Dr. Henry H. Rusby.

During the First World War various species of peat moss (*Sphagnum*) were used in the making of bandages, and they are now being so employed again. Thanks to the peculiar structure of the cells of sphagnum, it has excellent absorbent qualities. The moss is carefully cleaned of all extraneous

matter, dried, steam-sterilized, and made into gauze-covered pads of various sizes. Experience has shown that wounds heal much more quickly with sphagnum bandages than with cotton-batting bandages. This is explained by the fact that in addition to its draining qualities, the moss also contains certain disinfecting substances. Sphagnum is now being gathered and prepared on a large scale in Russia.

War has given new value to several kinds of seaweed that grow along American coasts. One is the giant kelp (*Macrocystis pyrifera*), a large brown alga of the Pacific coast. From this seaweed products are derived which may pinch-hit in some of the non-strategic uses for agar-agar, now on the priority list. Agar is a kind of vegetable gelatin indispensable in bacteriological and other medical research, and in certain industries.* The small amount of agar made in America has always been of good quality but insignificant in quantity. True agar is derived from Ceylon-moss (*Gracilaria lichenoides*) of the East Indies and China Sea. Other seaweeds that may have use have been discovered on the Florida coast.

Another seaweed widely used is Irish-moss or carrageen (*Chondrus crispus*), a dark-purple cartilaginous seaweed of the red alga group. It is used for purposes ranging from blanch-mange and ice cream to medicine (as a demulcent) and shoe polish. It is collected mainly along the Massachusetts coast, especially in the neighborhood of Scituate. In 1939 the crop was valued at \$24,000. By 1941 the harvest was so increased as to be valued at \$100,000.

Opium, derived from the latex of the incised unripe fruit-capsules of the opium poppy (*Papaver somniferum*), is still being imported from Iran, Turkey, India, and elsewhere in the Orient. It contains many alkaloids, of which morphine is most important. Half a million pounds of raw opium are locked in a vault in Washington. Its narcotic properties are well-known. Co-operating with the Bureau of Narcotics, the Bureau of Plant Industry has conducted research and developed ways of producing opium in the United States in case it becomes necessary. The Government now has information and suitable seed on hand to produce this valuable medicine in quantities that will fill the

*See "Farming at Ten Fathoms," by Curtis Zahn, in NATURAL HISTORY for January, 1944.

needs of both the armed forces and civilians should a war shortage develop.

Another valuable drug is stramonium, taken from the ubiquitous jimson-weed (*Datura stramonium*), a plant with large trumpet-shaped flowers and spiny pods. Its medicinal action is similar to belladonna, and it is also used in special cigarettes as a sedative in the relief of asthma, as is the substance cubeb (from *Piper cubeba*). When the war came and prices shot up, it was collected all over the countryside. Cultivated plots have been expanded and shipments came in from South America, so that an actual surplus is now on hand.

Ergot is an important drug that requires no additional land for production. It is not a green plant, but a tiny parasitic fungus (*Claviceps purpurea*). This fungus infests fields of various grasses, especially rye, and replaces the grain during warm moist weather. It contains powerful medicinal principles of value in preventing hemorrhage after childbirth and hastening delivery in the later stages of labor. Hitherto our supply of ergot has been imported from Russia and Spain, where it is produced cheaply, while our own supply was carefully screened out of rye grain and thrown away! If it is not removed from grain it will contaminate beer and bread, causing widespread poisoning in the form of spasms and circulatory disturbances or gangrene. When we read in old books how people's limbs sometimes mysteriously "dropped off," gangrenous ergot poisoning may in some instances have been the cause. In proper doses physicians find this drug of great value, and it is now being processed in the United States from rye screenings.

Digitalis, a vital heart stimulant, is derived from the dried leaves of the foxglove (*Digitalis purpurea*).

Menthol is the principal constituent of oil of peppermint and is extracted from the peppermint plant (*Mentha piperita*). America's menthol supply was formerly imported from the Far East. Now Oregon is the chief source. Its \$1,000,000 crop of peppermint has been declared a war crop by the Government.

One of the most strategic products of El Salvador, in Central America, is balsam-of-Peru. Its misleading name comes down to us from the days of the Spanish empire in America. Although no balsam-of-Peru came from Peru, the Spanish guarded it so jealously that every legitimate ounce of it had to

pass through the imperial customs at Callao, Peru, before it could go to Europe. Some 50,000 trees (*Myroxylon pereirae*) are now in production on the "balsam coast" of El Salvador, yielding from 300,000 to 500,000 pounds of crude balsam annually. It is obtained by removing patches of bark from the tree and scorching the wounds with torches. The heat causes the pitch to flow out, and this is then sopped up by means of cotton cloths placed over the wounds. When the cloths are wrung out in crude rope

presses the pure liquid balsam is obtained. Lives have already been saved in this war at army field dressing stations by a quick application of a protective coat of this powerful antiseptic to the surface of wounds.

The local anesthetic cocaine comes from the coca plant (*Erythroxylon*, especially *E. coca*), cultivated by the ancient Incas long before the time of Pizarro, who conquered them in 1531. The Indians still use it, carrying the leaves in the mouth mixed with a little lime, much in the manner of the ori-

Photo by Free-Lance Photographers Guild



▲ THE ESSENTIAL USE of morphine in medicine focuses attention on the opium poppy, here seen growing along the banks of the Nile, in Egypt. To forestall a possible war shortage, the Bureau of Plant Industry in cooperation with the Bureau of Narcotics has developed ways of producing sufficient quantities for medical use, both military and civilian



Photo by Bureau of Plant Industry, U.S.D.A.

▲ THE PLANT that produces menthol, the principle constituent of oil of peppermint: *Mentha piperrita*. America's supply formerly came from the Far East; Oregon's million-dollar crop has been declared a war crop by the Government



Kost' Ruohomaa from Black Star

ental betel-nut (*Piper betle*). It produces an anesthesia of the stomach which enables the natives to travel long distances without food or drink. It is by far the earliest drug plant of South America to be known in Europe, though it wasn't until 1884 that its value as a local anesthetic was recognized. Most of the world's strategic cocaine supply still comes from Bolivia and Peru, where its production is a considerable industry.

Mention should also be made of the plant *Taraktogenos kurzii*, source of the famous chaulmoogra oil, which has been tried on leprosy, though without agreement as to the results. Two other plants contribute in the production of chaulmoogra oil, *Hydnocarpus anthelmintica* and *H. castanea*. All three are native to Burma and Siam.

Scammony is a valuable cathartic obtained from *Convolvulus scammonia*, native to the eastern Mediterranean and Asia Minor, now difficult to obtain. An excellent substitute has been found in the sun-dried "ipomea-root," or Mexican scammony (*Ipomoea orizabensis*), which has similar

properties. Another important member of this family is the jalap (*Exogonium jalapa*), whose tuberous roots, cut from wild plants and dried in the smoke of hearth-fires, yield an important purgative.

Honduras and Mexico are supplying sarsaparilla, the dried bark of the roots of a prickly-stemmed Smilax, greatly resembling the sarsaparilla of Europe (*S. aspera*). It is one of the most commonly used New World drugs. It was employed as early as 1550 by European physicians in the treatment of syphilis. Although its curative powers in that respect are discredited today, it is still popular as a tonic and flavoring material to make certain medicinal preparations more palatable. In Europe it is used as a substitute for "China-root," an Oriental species of the same genus.

Asafetida, used with insane patients because of the distracting effect of its bad odor, is obtained from species of *Ferula* and is normally imported from India. Iran is the source of a gum used in cough drops derived from the tragacanth thorn-tree (*Astragalus*, es-

pecially *A. gummifer*). Gum arabic (*Acacia senegal* and *A. arabica*) comes from the Anglo-Egyptian Sudan. Benzoin (*Styrax benzoin*), a balsamic resin used in making benzoic acid and employed as a stimulant, expectorant, and perfume, is produced in the Netherlands Indies. All these and other valuable drug plants seem to be irreplaceable when present stocks are exhausted. Yet the Americas were in the drug business centuries before the days of Christopher Columbus. Early Indian medicine men of the Western Hemisphere gathered their drugs and medicinal plants as earnestly as the modern scientists. They employed over 100 species of native plants as stomachics, 137 as emetics, 68 as laxatives, 152 as cathartics, and 88 in the treatment of colds. One hundred thirteen plants were used for fevers by the Indians, 85 as diaphoretics, 36 for kidney troubles, 200 as diuretics, 101 as wound antiseptics, 44 as sedatives, 250 as tonics, more than 100 as stimulants! Early physicians used about 300 (or 20 per cent) of the old Indian herbs.



Severin photo from Three Lions

Photo by Ewing Galloway



Severin photo from Three Lions

▲A COCA plantation in the district of Yungas, Bolivia

Drug plants, normally unprofitable to raise because of low-cost hand labor abroad, now command high enough prices to repay cultivation under American conditions. One estimate states that the addition of a mere 3500 acres in assorted drug plants would take care of our ordinary needs. The New World could be made self-sufficient in vital drugs and medicines to assuage the world's pain and heal its sick.

(Other drug plants will be discussed in a later issue.)

◀THE PLANT which yields the local anesthetic cocaine was cultivated by the ancient Incas long before the Spanish conquest of Peru. Here Indians are seen harvesting the coca plant, which provides the basis for a considerable industry in Bolivia and Peru

◀GUM ARABIC, used in a variety of ways in pharmacy, comes from various acacias. Much of it is produced in the Anglo-Egyptian Sudan, where this photograph was taken

YOUR NEW BOOKS

SCIENCE AND CRITICISM • NETHERLANDS AMERICA

ANIMAL REVEILLE • INTRODUCING AFRICA

SCIENCE AND CRITICISM

----- by Herbert J. Muller

Yale University Press, \$3.75

IT is the fashion in certain quarters to disparage science, to lament the changes it has wrought in human and spiritual affairs, and to blame it for the ills that now beset mankind. A more insidious form of this attitude admits the contributions that science has made and can make to man's ability to manipulate his environment, but denies its competence to establish the values of what it is doing, calling this the function of art and philosophy.

Unfortunately, many scientists are blissfully unaware that they have been put in their proper place and continue to pursue their investigations without regard for the bounds which have been set for them. Perhaps it is well that they should. But the fact remains that the activities and concepts of science are exerting a powerful effect upon human society, undermining old faiths and blazing new vistas. Science has, therefore, been creating problems whose solutions require the element of evaluation.

Professor Muller has addressed himself to this matter of value in a notably catholic manner. He has surveyed the concepts developed in recent scientific writing and has related them to the functions of criticism, philosophy, and literature. The argument is closely woven, cogent, and, to this reviewer, eminently sane. His philosophy, which he calls scientific humanism, attempts a synthesis in the spirit of John Dewey, but his is not a slavish copy of the master. In the compass of a brief review it is not possible to develop any of Professor Muller's ideas or to elaborate any of his minor qualifications. The important thing is that Professor Muller has written a highly stimulating and significant book on a fundamental theme.

HARRY L. SHAPIRO.

FISHES OF BRITAIN'S RIVERS AND LAKES

----- by J. R. Norman

The King Penguin Books, London and New York. 32 pages, 16 plates

THE bold, colored illustrations found in this book, showing 32 of some 45 kinds of fresh-water fishes known in the British Isles, have historic interest as well as considerable artistic merit. They are

reproduced from Donovan's *Natural History of British Fishes*, published 1802 to 1808, and although not above criticism, will serve admirably to identify the species they represent. The text, by a scholar pre-eminent in his field, tells what one would wish to know about each species, after giving an interesting discussion of fishes in general. This is a little book that slips handily into the pocket and is well worth taking along when going fishing.

J. T. N.

ANIMAL REVEILLE

----- by Richard Dempewolff

Doubleday, Doran, and Co., \$3.00

ANIMALS have always taken part in or been affected by wars between peoples and nations. In the present conflict, mechanized as it may be, more use is being made of animal auxiliaries than ever before. The author has gathered together historical and contemporary information from many sources. Sometimes the past and present should be more clearly defined. Of course, the full story of animals in this war cannot be written for some time to come.

These stories from every front include tales of bravery and devotion to duty, anecdotes of humorous situations, and ac-

counts of the foibles of animals in war. Pets and zoo animals went through the London raids. Mascots are closely connected with morale on land and aboard ship, not to mention in airplanes. Wars are fought in all kinds of weather and terrain, and only the transport animals—faithful dogs, grumbling camels, well-trained horses, stubborn mules, and the earth-shaking elephants—enable supplies to go through at all times and under all conditions. Messenger animals, dogs and pigeons, combine secrecy with many other advantages and have been of great value both in this war and the last. The keen senses of the dog enable one man to keep better watch than six men can alone.

The style of the book is lively and humorous. A clearer and more authentic picture would have emerged if the author had been more skeptical about some of the details in his stories and if fewer accounts had been used. The illustrations are good photographs, chiefly from official sources, and they leave little to be desired.

J. E. and H. L. HILL.

NETHERLANDS AMERICA

----- by Philip Hanson Hiss

Duell, Sloan, and Pearce, \$3.50

THIS book is the most interesting and comprehensive treatise on the Dutch possessions in the Western Hemisphere that has come to my attention. Mr. Hiss is to be congratulated upon the presentation, which indicates a great deal of first-hand information coupled with an exhaustive search of literature.

I have visited the islands and territories Mr. Hiss discusses, and I agree that the Dutch and Americans have always shared a passion for freedom. The Dutch were our allies during the Revolution, and the first salute to the American flag given by a foreign power took place on November 16, 1776, at Fort Orange on the island of St. Eustatius. The Dutch gave succor to the Jews who escaped from the Spanish Inquisition in 1492, and they permitted them to settle in their colonial possessions early in the seventeenth century.

Mr. Hiss' discussion of economic and social conditions, combined with the intriguing history of these possessions, makes for fascinating reading. The battles fought intermittently among the Dutch, French, British, and Spanish for these small islands gives one an insight into the strategic importance of these territories. Few

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Above Illustration: Part of Plains Group, American Museum of Natural History. Photo by T. L. Bierwert and C. H. Coles



realize that the largest oil refineries in the world are on the barren islands of Curaçao and Aruba.

The largest territory held by the Dutch in the Western Hemisphere is Dutch Guiana—a 55,000-square-mile area that is largely jungle-covered. I do not agree that the future of this region, where most of our bauxite is being mined, is as bleak as Mr. Hiss would have us believe.

Since little exploration in the interior of Dutch Guiana has been attempted by the Dutch, the Indian population may be considerably larger than 2000 as indicated by the Government census. Having spent considerable time among the Bush Negroes of that colony, I cannot agree that the life of these people is "uncomplicated." On the other hand, it is a highly complicated and ritualistic type of existence. Bush Negro society is not "matriarchal" but is matrilineal. Nor can I agree that the Bush Negroes "differ very little from the town negroes of Paramaribo." Mr. Hiss states that the merits of Bush Negro carvings have been greatly exaggerated; I feel sure that he could have only seen most inferior specimens.

The book is copiously illustrated with photographs, every one of which is a masterpiece, and Mr. Hiss is to be especially congratulated upon his effort in this regard. All in all, the book is fascinating, and I recommend it without the slightest reserve.

MORTON C. KAHN.

INTRODUCING AFRICA

----- by Carveth Wells

G. P. Putnam's Sons, \$2.50

NEVER before has young America been seeing the world as during the present conflict, and the time is propitious for readable guides with dependable facts and figures. To cover a great continent in a book of 243 pages is no mean task, and Carveth Wells is a master of the art of popularization. He coats his statistics well with amusing anecdotes.

While there are only four independent nations in Africa, the remaining four dozen colonies, protectorates, mandates, and other geographic units all have individual characteristics; and then too must be mentioned the many adjacent islands. It would be hard to suggest a better way to start one's acquaintance with them all than through this book.

Geographic and ethnological features are well presented, though a specialist in

the latter field might offer a few corrections. It is pleasing to find many popular misconceptions about the "jungles" of Africa set to rights and the economic importance of the continent so well explained, especially since a large part of the Old World tropics has fallen into enemy hands.

Questions of native rights are treated fairly, except in the case of the former Congo Free State, where too much weight is given to stories of one-time cruelty and oppression. The present development of the Belgian Congo bears witness to the wisdom of its pioneers, and the prospects for the future of its native peoples compare favorably with those prevailing in any neighboring country.

Little space, of course, was available for natural history. Rhinoceroses are too widespread, and no walnut lumber comes out of the African tropics. The concluding chapter, on the multifarious native languages, is very informative. I must say that had I possessed such a book when I first went to Africa it would have been most helpful.

JAMES P. CHAPIN.

A BOOK OF LILIES

----- by Fred Stoker

The King Penguin Books, London and New York. 32 pages and 16 color plates

THIS little book treats of 16 species of lilies, of which one is Eurasian, three European, four American, and eight Asiatic. Each is illustrated by a good color plate, and these plates show the variety in color and form existing in the genus. The author discusses briefly the lily in art, holy writ, heraldry, herbalism, and as food, as well as the etymology of the names. The treatment is scholarly and convincing, the description leaning rather to the popular than to the scientific side.

CLYDE FISHER.

BONES AND VERDURE

----- by D. I. Macht

Baltimore, Md. (Privately printed)

DOCTOR MACHT, a pharmacologist and also a student of the Scriptures, brings together these two interests in a kind of scientific exegesis. He has culled an impressive number of citations out of the Old Testament to illustrate the scientific soundness of Scriptural references to human physiology.

H. L. S.

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THE CONTRIBUTION OF HOLLAND TO THE SCIENCES

- - - A symposium edited by A. J.
Barnouw and B. Landheer

Querido, \$3.50

THE senior editor has been for more than 20 years Queen Wilhelmina's Professor of the History, Language and Literature of the Netherlands at Columbia University. The book consists of 20 chapters written by different authors, every one an expert in his own field. The fields covered include theology, philosophy, philology, psychology, sociology, historiography, law, political economy, international law, history of art, musicology, oriental studies, library and archival science, astronomy, mathematics, physics, chemistry, medicine, botany, and architecture.

A survey of these chapter headings would suggest that the title of the book is not inclusive enough, but there is nothing misleading in these factual captions of the various articles. The first part of the book, consisting of thirteen chapters, is devoted to the humanities and social sciences, while the second part, consisting of seven chapters, is given over to the exact sciences and architecture.

The chapter on astronomy has been done by Dr. Jan Schilt, Rutherford Professor of Astronomy at Columbia University. This is a most readable story of the outstanding Dutch astronomers and their work, including Kapteyn, Hertzsprung, Oort, and de Sitter. The chapter on mathematics has been done by Dr. Dirk Jan Struik, Professor of Mathematics at Massachusetts Institute of Technology. The chapter on physics was written by Dr. Samuel Abraham Goudsmit, Professor of Physics at the University of Michigan, with the aid of I. Bernard Cohen of the Physics Department at Harvard University. Since astronomy, mathematics, and physics cannot be separated, we find the stories cannot be entirely distinct, as one finds in the work of Huygens, Lorentz, and others.

Chemistry with the name van 't Hoff; medicine with the name Leeuwenhoek, creator of the compound microscope (it is of interest here to recall that the inventor of the telescope, Lippershey, was also a Hollander); and botany with the name de Vries, all provide fascinating stories.

CLYDE FISHER.

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A GILA WOODPECKER at its nest in a cottonwood stump: a photograph taken by R. L. Cassell in the Imperial Valley, California. The camera was a 4 x 5 Graflex with 30-inch Dagor lens. A 1/330 second exposure was made at f.7.7.

SIRS:

... NATURAL HISTORY is one of the few magazines which depend in a large part upon exploration for article material yet have not suffered terribly from the war. Your excellent use of photographic features, "Strategic Metals" and "Strategic Plants," and discussions of old riddles which have for many years puzzled science, has kept your magazine as interesting and educational as ever. Of course,

we shall all be glad when you can resume reporting the findings of American Museum expeditions, but until then, you will surely be able to hold your old readers and gain many new ones through your excellent taste in picking substitutions.

A. J. BARTON.

USN V-12 Training Unit,
Lancaster, Pennsylvania.

LETTERS

SIRS:

In your February issue among the letters I noticed one in which the writer says that he does not like all your pictures. I am just the opposite. When I read the magazine, I learn mostly from the pictures. . . .

JOY RICHARDSON.

Passaic, New Jersey.

SIRS:

Having just received my first copy of NATURAL HISTORY Magazine, I have read the letter from one of your readers regarding the number of pictures. I hope you don't take his complaint seriously!

I am delighted with the magazine, and this is true *largely because of the illustrations*, which are as near perfect as any I have ever seen. They are in just a right proportion to the text, it seems to me. Pictures always remain longer in my memory than words, and when an article is accompanied with a wealth of illustrations its worth is multiplied a hundred fold.

A million words couldn't have shown us brontosaurus tracks as clearly as have these few pages! No verbal description would bring chickadee, or beaver, or cork tree (or any bird, beast, or plant) so vividly to mind as do these pictures!

Please, Mr. Editor, if you must cut somewhere, don't cut down on illustrations!

I agree with Bacon as quoted, but I can't help wondering what he would have said about this subject if printing in his day had made possible such aids to complete and accurate understanding!

MRS. ABIGAIL S. COLE.

New Rochelle, New York.

I am probably one of your youngest members but nevertheless I wish to tell you that your magazine has provided endless hours of enjoyment for me and my family. Especially I like your interesting and true-to-life photographs. They add to your articles. I find your magazine the only magazine I read straight through.

ELLEN T. UVILLER.

New York, N. Y.

ON YOUR RADIO

Program of the American Museum of Natural History for March, 1944.

WEDNESDAYS over WNYC
from 3:30 to 3:45 P.M.

Science for the Seven Million

March 1—*Peoples of Mexico*—

IRENE F. CYPHER

March 8—*You and the Black Market*—

LUCY CLAUSEN

March 15—*Bird's Eye View of the World*

IRENE F. CYPHER

March 22—*Design for Flight*—

LUCY CLAUSEN-ROBERT SNEDIGAR

March 29—*New World Legends*—

IRENE F. CYPHER-DR. ANNA

C. CHANDLER

This program is under the sponsorship of NATURAL HISTORY Magazine.



This photograph of a Mountain Goat [originally a Kodachrome] was taken near Sperry Glacier in Glacier National Park. I took the picture in August, 1942, while serving as a Ranger Naturalist in the Park. . . .

Your magazine is the most instructive and attractive I have found for use in the Biology classroom.

WILFORD L. MILLER.

Jamestown, North Dakota

would fail to penetrate it. From that moment, as stated, events passed beyond my control.

"Either blow from mattock or club would have killed a man instantly, yet neither caused the aardvark even to pause, surely indicating that it was not suffering.

"Your correspondent apparently assumes that the animal was killed for sport. On the contrary it was only for museum specimens that I ever shot animal or bird in Africa, never for sport, nor even for the pot except incidentally. In this connection Doctor Valentine might be interested to know that for seven years prior to the aardvark incident I was a strict vegetarian solely to avoid being implicated in the suffering inseparable from the slaughter of animals for food. If Doctor Valentine is not a vegetarian he should know that more harrowing incidents are happening daily in slaughter houses. I would like him to read 'A Terrible Indictment' (*Animal's Guardian*, 1914, pp. 22-23), in which I give my personal observations, written at a time when, for some years, I served as honorary secretary of an animal welfare organization. I much regret, therefore, that the interpretation he puts on something I have written should have caused mental suffering to one sensitively sympathetic towards animals."

* * *

SIRS:

. . . The Staff of your Museum is really to be praised for the editorial wonder

SIRS:

As you know, I have been a member of The American Museum of Natural History for a number of years and of course receive the magazine.

I have derived considerable pleasure from most of the articles in the above magazine but noticed an article in the January number written by a man by the name of A. Loveridge. I do not know whether he is a member of your staff or not, but I do know that the article concerning "The Aardvark and the Armistice" was the most cruel and brutal one I have ever read. This article should never have been published in the magazine but should have been reserved for a so-called sportsman magazine, whose chief aim and object is to kill everything that runs or flies. . . .

You, on various occasions, receive complimentary letters from admirers of the magazine. This letter is not in that direction, but I do hope that you will give it space in your next issue and discontinue this horrible event.

DR. A. W. VALENTINE.

Washington, D. C.

Mr. Loveridge writes in response:

"I had supposed it was perfectly clear that what occurred resulted from ignorance on my part. From the range at which I fired, the charge of shot would have killed any ordinary animal outright. I did not then know that an aardvark's hide was so tremendously thick that the shot

'Tis a guid whusky!

Consistently, the excellence of Teacher's Scotch has pleased knowing men since 1830. The reason is plain at first sip . . .

"It's the flavour"

SOLE U. S. AGENTS: Schieffelin & Co., NEW YORK CITY • IMPORTERS SINCE 1794

accomplished in publishing a thoroughly educative and strictly scientific magazine in a highly artistic manner. Many of the subjects treated in it are, of course, familiar to me, but this does not lessen the great pleasure of seeing them in a new and attractive form, which makes the reading of every page a joy for the professional naturalist as well as for the man in the street.

With my congratulations for the splendid work the American Museum of Natural History is doing amid the present difficult circumstances, I am,

Yours very sincerely,

A. CABRERA.

Universidad Nacional de La Plata,
Instituto del Museo,
La Plata, Argentina.



SIRS:

Perhaps some of your readers would be interested in seeing the accompanying photograph of a young bald eagle. When the picture was made last August the bird was approximately three months old and had not learned to fly.

Your handsome magazine is sent to me regularly by a friend in the States, and I eagerly look forward to each issue. After reading it, I route it back to the States by way of another Alaskan outpost.

EDWIN D. PEACOCK, RM 2/c.

Kodiak, Alaska.

* * *

SIRS:

As I look back over the last twelve months and check off the numerous blessings which have fallen to my lot, one stands well above the great majority, that of the privilege of reading the wonderful, delightful, and instructive articles embraced in NATURAL HISTORY. . . .

In the December issue, there are two articles, either one of which, to me, a student of natural history for many years, is worth far more than the price for the entire year's subscription, so it is again a pleasure to subscribe to your wonderful magazine. . . .

D. P. LEFEVRE.

Cumberland, Maryland.



BARLEY



WHEAT

SIRS:

In reading the article on "Wheat and Civilization" in the November issue of NATURAL HISTORY, I was surprised when I saw the illustrations of wheat, rye, oats, and barley.

Do the wheat and barley grains shown represent new varieties of these grains? . . . The seeds referred to as wheat in the picture look like barley to me, and those labeled barley look like wheat. . . .

LAURALEE LUTZ.

Hamden, Connecticut.

* * *

SIRS:

. . . The names under the pictures are switched. . . .

CARL ARMENTROUT.

Camp Davis, North Carolina.

SIRS:

. . . Wheat and barley have the wrong name under each. . . .

FRANCIS E. COBB.

Jamestown, North Dakota.

* * *

SIRS:

. . . The photographs of wheat and barley were interchanged. . . .

A. L. JOHNSON, JR.

Crete, Nebraska.

The captions were, to be sure, accidentally shifted. The photographs are correctly labeled above.—Ed.

SIRS:

. . . I cannot praise too highly your wonderful magazine. I devour its contents with enthusiasm. I take it to bed with me and finish it all too soon and have to wait impatiently for the next number.

LEONARD ATWOOD COMSTOCK

Madison, New Jersey.

* * *

SIRS:

. . . In our work here at the college museum, we find every copy of NATURAL HISTORY full of material that we can use to advantage in making the students and other visitors acquainted with the phenomena of nature.

Please accept our sincere compliments and thanks for your fine magazine.

Sincerely yours,

HOWARD L. FEATHER,

Associate Curator.

Franklin and Marshall College,
Lancaster, Pennsylvania.

* * *

SIRS:

. . . Since marrying and moving to the West Coast I have certainly missed NATURAL HISTORY Magazine. The last copy I received was the February issue, 1942, almost two years ago, and I know that I have missed many fine issues. There was always a race to see which of us children got the magazine first on the day of its arrival, and we have spent many pleasant hours with it. I'd like to send in my subscription. . . . I don't want to be without the magazine any longer.

(Mrs.) F. WILLIS.

Los Angeles, California.

* * *

SIRS:

NATURAL HISTORY has celebrated its third year as my pet magazine, and with this in mind I wish to acknowledge my gratitude to the ones responsible for its success.



SIRS:

I was especially interested in the article about four-leaf clovers by Mark Barr in the September NATURAL HISTORY. My own record (set while my husband repaired a tire!) is 13 of them on one plant.

Enclosed is a perfectly geometrical spray of maple leaves which I found one day while walking through the woods and photographed because it seemed so unusual to me.

We enjoy your beautiful magazine so much.

Mrs. M. J. HOFFER.

Rogers City, Michigan.



April

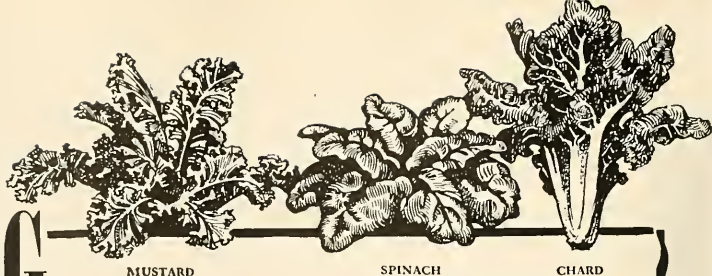
NATURAL HISTORY

1944

Peoples of the Pacific • Idaho's Craters of the Moon

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(Victory Garden edition)
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In addition to the comprehensive details on every type of gardening, this book gives detailed plans and layouts for the Victory Garden.

GARDEN FLOWERS IN COLOR

by Daniel J. Foley \$1.98
A picture cyclopedia of flowers, in color. Practically every commonly known garden flower is represented here. The color photographs are beautiful and will inspire you to make your garden a realm of charm.

VEGETABLE GARDENING IN COLOR

by Daniel J. Foley \$2.50
Here too is a picture cyclopedia, but it deals only in vegetables. The text is instructive as well as comprehensive.

WE FARM FOR A HOBBY AND MAKE IT PAY

by Henry Tetlow 69¢
A business man moved to the country to reduce expenses—still keeping his job in the city. The book tells how he and his family profited by the transition and found enjoyment as well.

KNOWING THE WEATHER

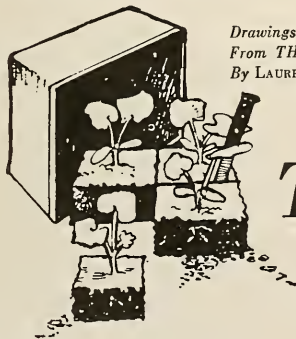
by T. Morris Longstreth \$1.69
If you are going to be a gardener you might as well know something about the weather, because if you don't, you will have its hazards added to the perils of pests. This book is very popular and helpful.

INSECT CONTROL IN THE VICTORY GARDEN

by C. H. Curran 25¢
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Drawings by LAURENCE BLAIR
From *THE FOOD GARDEN*
By LAURENCE and EDNA BLAIR
MACMILLAN, 1943

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Facts and Opinions

IF the scientists felt free to leave the platform of assumed superior knowledge, onto which they are now forced by their public, and could mingle in the discussion on the floor without being misunderstood when they speak from personal judgment and opinion and not from knowledge only, what is it they could contribute to human progress that they do not already contribute in full measure today?

Facts are not motivating forces for action. Even if all the facts should ultimately be known, action would still spring from opinions only. But intelligent opinion should be well informed of all the facts and should be built upon them. A proper understanding of the true meaning and significance of factual knowledge is precisely what the scientists have been specially trained to achieve. Nevertheless this is also the ability which they feel most constrained from exercising due to the prevalent conception of their falsely exalted role in life. To preserve the image of infallible science they must never venture a fallible opinion of their own and must therefore withhold their judgment of human problems which concern them as much as they concern anybody else, and on which they might make a better guess than most.

But man must act, however deep his ignorance of what he is facing. And opinions must be formed to create order in his actions and give him the strength of faith in his aims. The strategist facing the enemy cannot wait for the assurance of complete knowledge about the mysteries of ocean and air before putting his ships to sea and

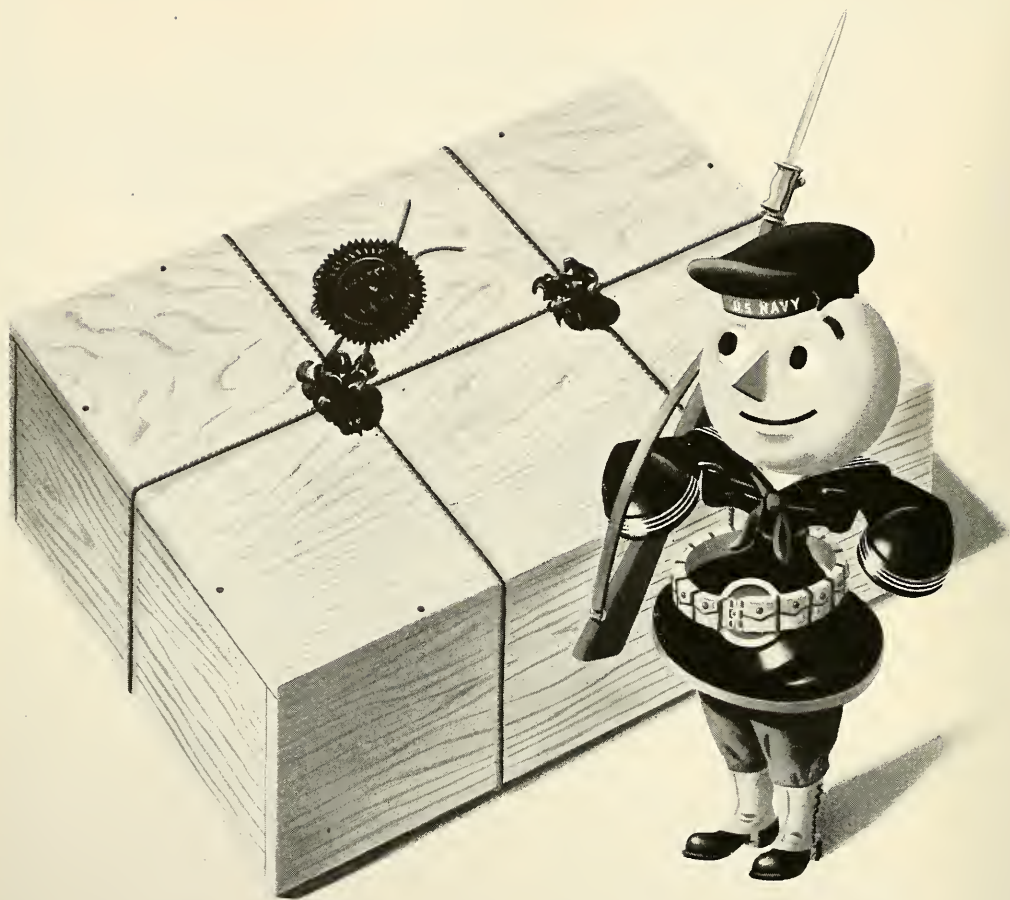
sending his air force aloft. The public administrator in the midst of a social crisis cannot wait for the final answer as to its causes and cures, but must act according to his lights with faith in his convictions and opinions.

In the molding of the opinions by which humanity moves forward the scientists themselves take little part. Their facts are used, conscientiously or with ulterior motives, wisely or foolishly, by essayists and columnists, statesmen and politicians, editors, club-members, and the person you met on a train. But, with a self-restraint imposed by an unsound public evaluation of their status, the scientists generally refrain from participating in the public discussion and the social interpretation of their own product. Yet whose opinion could be better informed of the facts than theirs? Who should be better able to judge the significance of our knowledge than those whose judgment produces the knowledge for us? How many errors could not have been avoided if science had been permitted to err with the rest of the world?

The future can never become a fact in the present. Therefore, those who are doomed to speak from facts of knowledge only can never make any real contribution to the discussion of the future, however great their ability to do so. If the sciences were released from the bonds of a superstitious faith in their magical powers, they could help us far more than they do in creating the opinions and convictions we need for the guidance of our daily actions and our future aspirations.

A. E. Barr

*Director, The American Museum
of Natural History.*



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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ALBERT E. PARR, Director

VOLUME LIII—No. 4

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APRIL, 1944

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◀ "OLD MAN BUFFALO," dependent on a dole of hay, is a spiritless counterpart of his ancestor

PHOTOS COURTESY NATIONAL PARK SERVICE



Buffalo go Wild

Once threatened with extinction, the buffalo was "bottle nursed" back to a safe existence. The question now is whether the public shall see semidomesticated buffalo behind fences or vigorous wild herds

By VICTOR H. CAHALANE*

SHADES of Buffalo Bill! Loud guffaws must still rock his coffin. Buffalo Bill who helped to slaughter millions of buffalo like vermin! He lived to see the few surviving animals being tenderly bred, fed, and propagated. Bulls were carefully held in separate pastures from the cows, except when breeding was desired. Calves were taken from their mothers and brought up on formulas and bot-

tles. Male calves not needed for breeding purposes were castrated. The wild buffalo became tame,—domesticated.

The slaughter of the American buffalo or bison is a discreditable page of history, well known to every American. Once the most abundant game animal on earth, the buffalo roamed in many millions. The great slaughter of the 1860's and '70's left so few that the survivors were counted to the last one. Only 541! Except for perhaps 22 animals in Yellowstone Park, all

of the remaining buffalo were under fence, managed like—and often with—domestic cattle.

Ancient bones of buffalo are buried deep in layers of travertine of the hot springs and pools of Yellowstone. These buffalo made a comfortable living on the slopes of this great mountainous region, centuries before Buffalo Bill was born. As late as 1880, an early superintendent reported herds still totaling 600 individuals. But the slaughter pushed on and sought out these survivors. By 1902, not even 25 of these buffalo were left alive.

In 1902 Congress appropriated \$15,000 to save the buffalo from the extinction that seemed imminent. A site was selected in Yellowstone Park, and buildings, corrals, and fences were constructed. Twenty-one animals were

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Chairman of the Bird Protection Committee of the American Ornithologists' Union. Readers may recall other articles by Mr. Cahalane in magazines embracing a wide range of popular and scientific fields from the *Saturday Evening Post* to the *Journal of Mammalogy*.—ED.

purchased as the nucleus of the new herd. To these were added a few calves that were captured from the wild bands in the Park.

Because of the emergency, stock-raising measures were adopted. As the limited pastures became overgrazed, hay was fed as needed in summer, as well as throughout the winter. Under this fond care, the herd increased rapidly.

The American Bison Society was established in 1905. Under the driving enthusiasm of such founders as Theodore Roosevelt, William T. Hornaday, and others, Congress helped to start more buffalo herds. The most notable and successful were at the National Bison Range in Montana, the Wichita National Game Preserve in Oklahoma, the Wind Cave Preserve in South Dakota and the Niobrara Preserve in Nebraska. These, and numerous smaller herds, were founded with buffalo from Yellowstone and from the Bison Society's

collection of animals at the Bronx Zoo.

Within 20 years the bison—once considered lost forever—had multiplied beyond all hopes and even needs. The question of how to feed them became critical. The old West was gone. The tall-grass prairies were plowed. Corn and hogs were being raised there. The short-grass plains were crisscrossed with barbed-wire fences and stocked with white-faced Herefords. For the original American livestock, the road back was closed. The future seemed to run monotonously between high wire fences.

With the sole exceptions of the Yellowstone wild buffalo, the Peace River herds in northwestern Canada, and a small introduced herd in Alaska, all the bison herds by 1943 existed in a state of semidomestication. They

totaled more than 5000 animals in the United States. Pastured behind fences, their daily lives are regulated, and future generations are molded according to human notions of "proper conformation."

Over the years, the various management measures once considered necessary for care of the Yellowstone "tame" herd at the Buffalo Ranch in the Lamar Valley have been dropped one by one. It has become no longer necessary to save every possible calf, to coddle and protect it from the bumps that make an adult bison a rugged and hardy creature. Except for the periodic removal of surplus animals because of food limitations, only one management practice of this tame herd has survived. The herd is still given a winter dole of hay.

To biologists, the drawbacks of

▼ THE LAST ROUNDUP, filmed in Yellowstone for a motion picture play about 1930





▲ IN 1902 fewer than 25 buffalo remained alive in the Yellowstone area. Since then, even with the re-

moval of over 2000 animals, the herds have increased to 1000. Overgrazing has become a problem





▲ THE BUFFALO RANCH in the Lamar Valley, Yellowstone. The food supply of other animals is

threatened. Ration-feeding replaces the independence and freedom the buffalo once enjoyed

◀ BISON in a corral, cared for much as domestic cattle



➤ "OLD MAN BUFFALO" ready to charge



▲ HAY HELPED SAVE the buffalo, but it also reduced the animal to a state of dependence and laziness

feeding wildlife have been demonstrated repeatedly. Perhaps the piles of carcasses surrounding the artificial feeding grounds of the elk in Jackson Hole and of deer in the Gunnison region of Colorado are the most dramatic examples. Animals attracted to feeding grounds crowd together. Any disease carried by one is more easily transmitted to others. Animals on a dole, much like humans, become unable to shift for themselves. In Jackson Hole, some of the elk become so indolent that many of them go only a few feet away after filling their stomachs with hay. Taking no exercise, they lie down, catch pneumonia.

Although the American bison is a more rugged character than the deer, the elk, or the antelope, biologists believe that artificial feeding is not less harmful for him than for his smaller cousins. The effects of a dole may be imperceptible for years; eventually they accumulate and result in domestication. Witness the reindeer! Imported to Alaska, the reindeer still must be herded and watched over, or they fall prey to the wolves. Sometimes they run off with their near relatives the caribou, but they cannot survive on their own resources. The reindeer race has been too long dependent on man.

Doubting Thomases may scoff at the assertion that the buffalo are being pampered into tameness. Compare our "hay-fed" buffalo with those described in 1800 by Alexander Henry in North Dakota, when the West was still wild:

"It is surprising how sagacious these animals are. When in the least alarmed they will smell the track of even a single person in the grass, and run away in a contrary direction. I have seen large herds, walking very slowly to pasture and feeding as they went, come to a place where some persons had passed on foot, when they would instantly stop, smell the ground, draw back a few paces, bowlow, and tear up the earth with their horns."

Is the buffalo of today "sagacious," alert, wary?

No! He is heedless, dull, almost stupid.

There are now about 1200 buffalo (including both "wild" and "tame" herds) in Yellowstone Park. The annual increase is 20 to 25 percent.

These buffalo must share their range with elk, antelope, bighorn, and moose. As a result there is not adequate winter food for any of them. Even the mule deer, which has been driven by shortage of browse to grazing, is threatened. The white-tailed

deer have already been exterminated in the Park.

Most important of all, the range forage is suffering serious, perhaps permanent damage. Even when the various animals are reduced to lesser numbers, it will take many years for the winter food plants to recover.

The buffalo's ancient enemy, the wolf, was exterminated in the Park fully 20 years ago. Man must take the predator's place in keeping the herds within natural bounds, and thus from eating themselves out of house and home.

More than 2000 buffalo have been removed over a period of years. But with some 125 to 200 calves arriving each year and in time starting new generations, the winter range continues to be overgrazed.

Several hundred bison, wild descendants of the original remnants that survived the great slaughter, have foraged for themselves throughout Yellowstone's fiercest winters. The offspring of these wild herds are in excellent condition. By a gradual tapering off of artificial feeding, the tame herd should also learn to shift for themselves.

When these tame buffalo go wild and become self-supporting, they will need more grazing per head than the insufficient amount that is available

now. There is only one solution to this problem:

This winter, 400 surplus buffalo have been removed from the tame herd. This leaves 350 "tame" buffalo and 300 "wild" buffalo in various parts of Yellowstone. The Lamar hay ranch, corrals, and buildings are to be kept until the tame herd has become self-supporting and has proved that it needs no human aid.

Outstanding scientists throughout the country agree almost unanimously that the buffalo herd in Yellowstone had to be reduced and must be maintained at a level that can be supported by the range, unaided.

A few lone voices lament the reduction. One objector fears that the re-

duction of numbers has endangered the race. There is no ground for this fear. There are 5000 buffalo in the United States, and over 15,000 in Canada. It is unlikely that our 5000 buffalo, spread over 14 states, are going to die off over night, in a day, or a year.

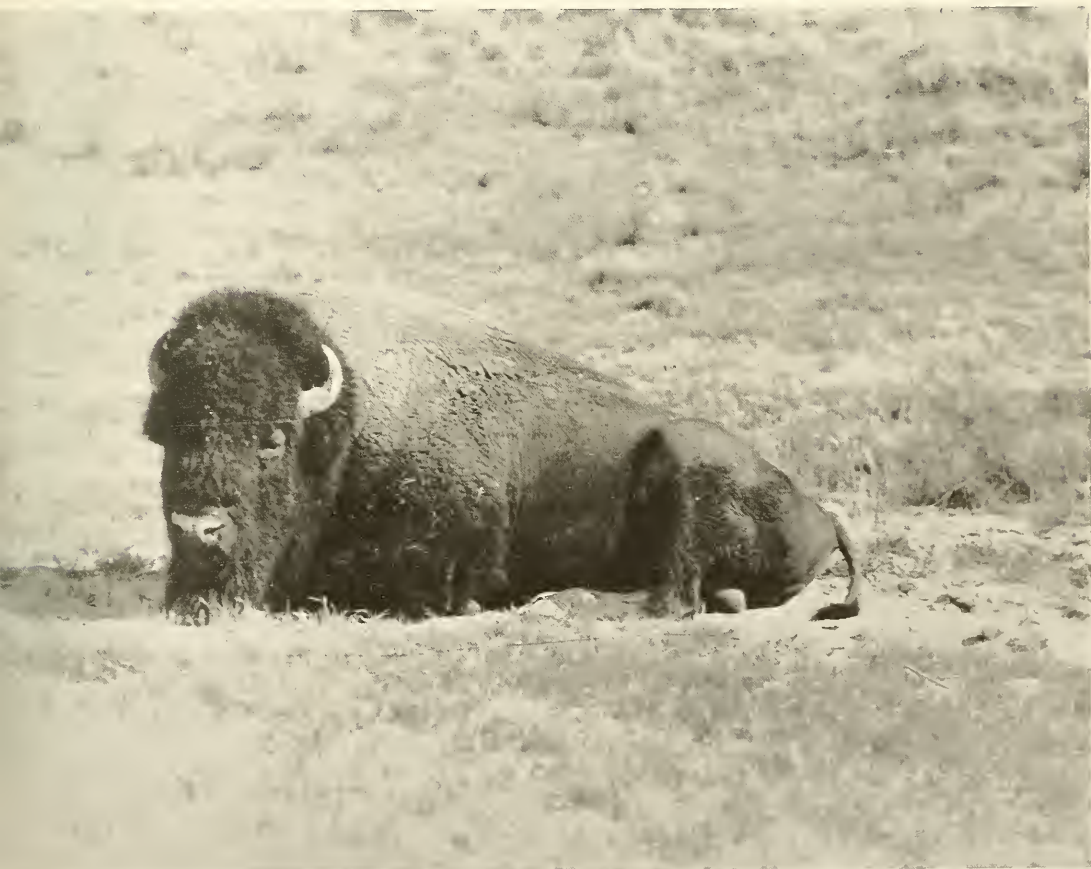
The ideal solution for the surplus buffalo will be found when a good-size sample of the High Plains can be salvaged and restored. An exhibit of the short-grass prairies, with the teeming animal populations that were so important in this country's history, will be forever valuable and fascinating to the American people. Surplus buffalo can be brought from Yellowstone. Wild buffalo,—not lazy, pam-

pered animals that can't support themselves. A truly great buffalo herd can then be re-established. Until that time arrives, we should preserve a nucleus of wild buffalo, unaltered by civilization. Yellowstone is the only National Park in this country that is large enough for this purpose.

To preserve these wild buffalo, we must preserve the Park. By keeping all of the types of animals below the carrying capacity, the range will ultimately be restored to provide adequate winter forage for larger numbers. And while this rehabilitation is taking place, even a small herd of wild, thundering buffalo will be more interesting to the visitor than a larger herd of apathetic zoolike animals.

▼ THERE IS NOT enough range food in Yellowstone for the buffalo, elk, antelope, bighorn, and moose. Facilities for feeding needy buffalo in winter will be maintained until the animals can

return to their natural life and a balance is reached between the wildlife population and their range. Then the visitor will see the buffalo as he really was, not as a "zoo animal"



NUMBER VIII IN A SERIES OF ARTICLES ON

STRATEGIC PLANTS

Scientific research prompted by world conditions leads to new adaptations and new localities for plants providing vital insecticides, dyes, and tanning agents

By HAROLD N. MOLDENKE

WHETHER one dates the start of the present war at 1941, 1931, or 1914, the fact is that there is another war in which the world is engaged that goes back for centuries. This is the war against certain insects that destroy our crops or transmit diseases, and up to recently it has been a very one-sided war with the initiative held by the enemy. Estimates of the number of different kinds of insects in the world range from

600,000 upward. Insects do man a vast amount of good (to mention only one of their services we would not have fruits or many of our other crops without their pollination); but those that are destructive in one way or another to man or his works though constituting a distinct minority are sufficiently potent nevertheless to require constant vigilance in controlling their activities.

At a time like the present, when, in addition to fighting insect enemies, man is also engaged in mortal combat

INSECTICIDE:
Pyrethrum
(*Chrysanthemum*
cinerariaefolium)

Drawings by
Natalie Harlan Davis





U.S.D.A. Photographs by Knell

◀ THE NEW INSECTICIDE "BOMB" contains a volatile solution that is released as a mist. Insects carrying malaria or other diseases are thus efficiently killed in the soldier's tent and elsewhere

▲ IMMEDIATELY ON LANDING in the United States every Army and Navy plane flying in from a foreign country is fumigated to destroy any insect stowaways. The mist, harmless to human beings, can be released while the crew and passengers are on board. Commercial air transport companies also have adopted this method of excluding insect hitch-hikers that might carry diseases or endanger crops

with his fellow man, it becomes even more essential for him to keep his flanks protected, his supply lines intact, his home bases functioning smoothly. So it has become even more urgent than ever to retain the upper hand in the war against destructive insects and their relatives.

Some of man's most dread diseases, like malaria and yellow fever, are carried by insects. Rubber-tappers in the tropical forests of Amazonia and cinchona-gatherers on the slopes of the Andes, as well as the hundreds of thousands of troops stationed and fighting in tropical lands, must be supplied with weapons against *all* their enemies—the 6- and 8-legged ones as well as the 2-legged. Insecticides constitute the most powerful of these weapons, and among insecticides the pyrethrins and rotenone are the most famous and strategic.

Pyrethrum

The pyrethrins in pyrethrum powder are produced by the daisy-like *Chrysanthemum cinerariaefolium*, native to Dalmatia. In 1940 United States

imports of this potent insect poison were valued at close to \$4,000,000. Today the Army is using "bombs" containing pyrethrum oleoresin to bomb out malaria-bearing mosquitoes and other insect enemies on the battlefronts of Europe, Africa, and the Pacific. Over a million of these bombs have already been sent to Army units in combat areas. They are considered so superior to the former spray methods that the entire output has been restricted to military use. The grenade-like cases keep the pyrethrum oleoresin inside under high pressure ready for instant release by the mere pressure of a thumb. The pyrethrum oleoresin is dissolved in a highly volatile solvent which, upon expulsion from the case,

atomizes the insecticide into an aerosol, or fog. One bomb expended at intervals will emit enough of this fog to kill all the mosquitoes in 10 rooms, each 10 feet high and 10 feet square, every day for 50 days. It will penetrate everywhere that smoke would penetrate, but is harmless to man and other warm-blooded animals. It is expected that after the war these "bombs" will make powerful weapons against the host of household and farm insects in temperate and tropical regions. It should be remembered, however, that indiscriminate use of these methods eliminates beneficial insects as well as harmful ones.

Thirty years ago the Dalmatian coast was practically the only source of this strategic poison. However, during the first World War, Japan took over pyrethrum production and soon was the chief source of supply for the world. Before Pearl Harbor, however, Japan had yielded first place to British Kenya. The present war has brought a great increase in the demand for pyrethrum and other insecticides because great quantities are

INSECTICIDE:

Rotenone
(*Derris*)



needed to combat the mosquitoes that spread malaria and yellow fever among the legions of troops and civilian workers sent to carry on the war in the tropics.

Ten thousand pounds of pyrethrum seed were flown from Kenya to Brazil. Part of this seed is being used to improve the strain, the rest is being distributed to farmers in suitable areas in Latin-American countries. United States Government scientists are supplying technical advice on growing, cultivating, and harvesting the crop. This is part of the inter-American co-operation for development of hemisphere resources. Pyrethrum-growing programs are already under way in Brazil, Chile, Argentina, Ecuador, Guatemala, and Mexico. Peru has produced pyrethrum for some time.

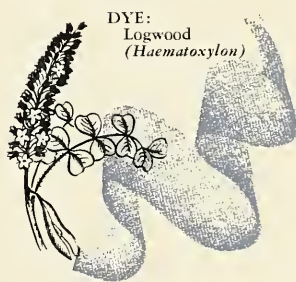
Fields of pyrethrum resemble fields of ordinary daisies, except that a larger number of blossoms are produced per plant. The powder is derived from the ground-up flower heads. These are harvested by hand-picking, by sickle-cutting, or by machine.

Besides carrying disease germs to man himself, insects cause an estimated two billion dollars worth of damage to crops every year. Development of facilities for travel, especially international air travel, vastly increases the danger of spreading crop pests and disease-carrying insects into new regions and countries. Hundreds of entomologists have been commissioned to carry on insect control work in the military services, and large staffs of trained men will be required in this field after the war. Increased activity in insecticide research has naturally been undertaken.

Powdered sabadilla seed (*Schoenocaulon officinale*) has long been used as a powder insecticide to destroy lice and roaches, and it is now reported that it can be processed for use as a spray. It may serve to replace, at least in part, the war-limited supply of pyrethrum in many household and crop sprays, though there has been a handicap in the toxic effect of its constituents on warm-blooded animals. The plant is native to Mexico and is related to the plants producing the potent hellebore (*Veratrum*). Powdered sabadilla was used by the Germans in the last war to form a poisonous dispersion or fog for use against enemy troops.

The present supply is imported mostly from Mexico and Venezuela.

About 300,000 pounds are used annually in lice and roach powder. Some three million pounds will be needed if it is to replace pyrethrum in domestic home-front uses. Three North American species of sabadilla (*S. drummondii*, *S. gracile*, *S. texanum*) have been found growing as weeds in Texas. They had not been used previously because the powder from their seeds did not seem to have sufficient insecticidal properties, but in the new spray it is highly effective. It would seem, therefore, that the United States may be able to raise much of the



DYE:
Logwood
(*Haematoxylon*)

amount needed to supplement the available Latin-American supply.

Rotenone

Easily equal to pyrethrum in strategic importance as an insecticide is rotenone. This is a poisonous crystalline substance, $C_{22}H_{22}O_6$, found in certain members of the pea family called "fish-poisons." Even before the discovery of the New World by Columbus, Indians in South America used rotenone-bearing plants to paralyze fish in streams, but only in the last decade have rotenone-containing insecticides been standardized and come into common use. At least 70 species of plants have been reported to give tests for rotenone, but the substance has been isolated in pure form from only a few species. Radlkofer in 1886 listed 154 species of fish-poisons. The chief genera are *Derris* (about 30 species), *Lonchocarpus* (about 37 species), *Mundulea*, and *Tephrosia*. Like the pyrethrins, rotenone has the unique quality of killing cold-blooded animals, particularly insects, while being comparatively harmless to human beings and other warm-blooded animals. Because of the shortage of rotenone, stringent restrictions on its use have been enforced by the Government. Farmers were permitted to use it only on certain crops and against certain

types of pests. Following the increased supply of rotenone-bearing roots received last year from the other Americas, particularly from Brazil and Peru, the United States War Food Administration is now permitting the use of rotenone insecticides on a larger list of fruits and vegetables than previously. The supply, however, is still limited in relation to the total demand.

Before the war the United States secured nearly half of its rotenone from Java, the Philippines, Malaya, and other parts of the Far East, where a large proportion of the fish-poison plants are native. When the Japanese cut off this source of supply, America had to turn to its own tropics. A program to bring about the expansion of rotenone production in the Western Hemisphere was arranged with eleven of the other American countries by United States Government agencies.

Present supplies of rotenone-bearing roots from Central and South America are mainly from wild or semi-wild plants. Peru and Brazil are the chief exporters of rotenone-bearing roots to the United States. Wild roots are also being gathered in Ecuador, Colombia, and Venezuela. Programs for the development of permanent rotenone-production industries have been launched in Peru, Brazil, Ecuador, Mexico, Guatemala, Costa Rica, Honduras, El Salvador, and Haiti, involving the planting of several million derris cuttings. A hundred thousand cuttings have been planted in Haiti alone and more than a million in Ecuador. By the spring of this year it is planned to have one and a half million derris plants growing in Mexico and Central America. The cuttings are mostly flown by airplane from the experiment station in Puerto Rico to plantations in the other American countries. Two years are required for the crops to be ready for harvest, so the full value of the cultivated crop will not be realized until 1945.

In addition to its many other uses, rotenone is almost the only known effective poison for ticks, which transmit the deadly Rocky Mountain spotted fever. Its use for this purpose is a public health necessity. Approximately four and a half million pounds of rotenone roots were imported by the United States from Western Hemisphere sources last year. The value of rotenone in agriculture becomes increasingly great every year, since it is used to combat weevils, aphids, bean-beetles, cabbage-worms, corn-borers,

fleas, flies, lice, ox-warbles, and other truck and livestock pests. Rotenone-treated vegetables can be safely eaten by human beings without any ill effects.

Among the most important of the rotenone-bearing plants figuring in the news today are cube (*Lonchorpus nicou*, *L. utilis*), barbasco (*L. urucu*), timbo (*L. floribundus*, *L. sylvestris*),*

*The names barbasco and timbo are also applied to *Lonchocarpus nicou* and *L. utilis*. Barbasco is also derived from the ever-green tree, *Jacquinia pubescens*.

► **ROOTS OF THE THUNDER GOD VINE** growing at Glenn Dale, Maryland, from cuttings obtained by a plant explorer of the United States Department of Agriculture. To ascertain whether it can be used here as in China, chemists and insect scientists are now testing an insecticide prepared from these roots

▼ **TO BE SATISFACTORY** an insecticide must be toxic to the insect and harmless to the plant. Therefore, it is necessary to test a new insecticide on a large number of different plants, as shown here in the Beltsville Research Center of the United States Department of Agriculture

U.S.D.A. Photograph by Knell



U.S.D.A. Photograph by Purdy





TANNING AGENT:
Quebracho wood
(*Schinopsis lorentzii*)

tube (*Derris elliptica*), and the coral-trees (*Erythrina*). In Dominica, *enrage* (*Clibadium sylvestre*), *barra* (*Diospyros ebenaster*), and *cicero* or *bois pipiri* (*Jupunba trapezifolia*) are used as fish-poisons. In 1936 the United States imported over 700,000 pounds of crude cube, timbo, and barbasco root, over a million pounds of powdered timbo root, and over 500,000 pounds of crude derris root. Although the literature on insecticides contains many more references to *Derris* (mostly Asiatic) than to *Lonchocarpus* (mostly American), the latter is receiving more and more attention now. Insects controlled by one are in most cases also controlled by the other, and entomologists are beginning to speak of rotenone dusts and sprays without specifying whether made from *Derris* or *Lonchocarpus*.

Another group of plants receiving much attention these days because of their medicinal value, especially to men on the fighting fronts, are the arrow-poisons. Arrow-poisons may be classified into 5 groups in accordance with the realm of their chief action: (1) those affecting heart and muscles (cuabain, strophanthin), (2) those affecting nerve-endings (curare), (3) those affecting the nervous system and heart in general (aconitine), (4) those affecting the spinal cord (strychnine), and (5) those having a general systemic effect (snake venom). Arrow-poisons derived from plants come only from the angiosperms (those having seeds in a closed ovary), and the most effective and widely publicized of these substances in the Western Hemisphere is curare. This is prepared from the stems of a number of tropical American species of *Strychnos* and members of the moonseed family. The substance contains two alkaloids, *curine* and *curarine*, which paralyze the motor end-plates. The action is very specific and rapid. Curare is now being employed in the treatment of certain nervous and muscular disturbances—St. Vitus' dance, Parkinson's disease, etc. Many of the leading drug companies of America are encouraging exploration in tropical

America for new sources of curare and conducting scientific research on the various types, their differentiation, chemical nature, and effects.

Dyes

Vegetable dyes are not at present as important economically as they once were, because of the advent of synthetic coal tar dyes. Some are, however, still of considerable value, and it has become necessary to search for substitutes among Western Hemisphere plants. In classical times brown and yellow dyes came from the saffron (*Crocus sativus*), which is also employed in medicine, perfumery, and as a spice; blue came from the woad plant (*Isatis tinctoria*); purple from a lichen, (*Rocella tinctoria*); black from the bark of alder (*Alnus*) or just plain charcoal; green from a mixture of thistle (*Cirsium*) and woad; and red from the madder (*Rubia tinctoria*). One of the most valuable

coloring principles today, haematoxylin, for black or blue dyeing of fine woolsens, cottons, silks, and leather, is obtained from Central American logwood (*Haematoxylon*). Central American brazilwood (*H. brasiletto*), used also in cabinet-making, produces red and purple dyes; and fustic (*Chlorophora tinctoria*) produces a yellow dye. News releases now tell that even the sassafras of our eastern woods and fencerows is being pressed into service as a source of dye.

Tanning agents

There are 143 Latin-American plants yielding vegetable tannin, the substance used in tanning leather. These are becoming increasingly important to American industry because of the rapid extinction of the native chestnut trees by a highly contagious blight which struck this country shortly after World War I.

Mangrove extract as a source of

▼ TO AID in the commercial cultivation of castor bean plants, tests are made on the growth of plants that have received nutrients in varying combinations

U.S.D.A. Photograph by Smith

► INSECTICIDES IN THE MAKING. Active constituents of an organic material under study for the control of insect enemies are being isolated here by a chemist at the Beltsville Research Center





U.S.D.A. Photograph by Kneil

tannin was in peace-time imported from Portuguese East Africa, being taken from the plant *Rhizophora mangle*. The same species of mangrove, however, grows abundantly on tropical American shores, and an American tannin-extracting industry may have to be developed.

All in all, quebracho wood (*Schinopsis lorentzii*), from Argentine and Paraguay, is the most important tanning material anywhere in the world today and is of strategic importance to the United Nations. The manufacturers of leather have long searched the world for vegetable tanning materials to provide the tans and tannin extracts required to produce the qualities of leather best suited for the multiplicity of uses that leather must now serve. Leather is an imperative necessity for armed forces and civilians alike in our present civiliza-

tion, and it must be properly tanned.

The tara bush (*Caesalpinia tinctoria*) is now being used extensively in Peru as the source of an extract for tanning leather. It grows wild along the foothills of the western slope of the Andes and bears a long pod filled with seeds. The pod and the pulp surrounding the seeds have a tannin content of 50 to 60 per cent. This is even higher than is found in the classic sumac (*Rhus coriaria*), cultivated for this purpose in southern Europe and now unavailable because of the war. It has nearly twice as much tannin as is provided by quebracho wood.

The pods are gathered at the end of the dry season. They are either baled for export as collected or are threshed out by letting horses trample them. In peacetime this product had a value of about \$3.00 per 100 pounds,

but now the value is much greater. Exports from Peru have risen rapidly from 490 tons in 1939 to nearly 1500 tons in 1941, chiefly to the United States. It is now planned to establish tara plantations on thousands of uncultivated acres along the coast of Peru. A relative, the divi divi (*C. coriaria*), is used for tanning in the West Indies.

So, from the boots and belts and leather holsters that our doughboys wear as they wade through the mire of Italy or New Guinea, and the dyed camouflage material that conceals them in dangerous positions, to the insecticide bombs they use to kill deadly disease-bearing mosquitoes and lice, strategic plants are giving vital protection to our loved ones in the armed forces, as well as on the homefronts.

[Next month: vegetable oils]

The GREAT



Numerous trips into the treetops brought the reward of intimate acquaintanceship with the home life of these large birds

HIGH on the hill in the tops of the oaks, something was moving. I trained my surveying transit, which consisted mainly of a 20-power telescope mounted on a tripod, on the spot. Several large birds with long necks and long legs were standing on the topmost branches of the tallest trees. They were bluish-gray in color, and some were slightly crested. While I watched, one flew down to the lake in Southern California where we were surveying, and

▲ THE GREAT BLUE HERON in flight, showing the feather arrangement as it glides from a hilltop toward the nest

alighted on a willow tree—close enough for me to see plainly the yellow iris of its eye through the telescope.

On subsequent days I continued to watch the hillside during spare moments in my work.

Soon the birds were carrying sticks to these same treetops. One afternoon a few days later we finished our job

early, and hiked up to the nest tree. I had a Leica camera with me, so I climbed the tree to take some pictures of the four eggs in the only nest I was able to reach. There were several other nests close by, including two more in the same oak, but these were so situated in the very top branches that I found it impossible to get to them.

BLUE HERON

By DONALD L. BLEITZ

(PHOTOGRAPHS BY THE AUTHOR)

Soon after that we finished the survey of the lake and left the area. It was not until some time later that I identified these birds as Great Blue Herons.

From the engineering business I gradually entered the photographic field and through an acquaintance became so interested in birds that I decided to make bird photography my hobby. Remembering the herons, I determined to visit the lake again in 1941 and to make careful observations and photographs.

During the latter part of February, the herons began to carry large sticks to their nests in the tops of the oaks on the hillside, not far from where I had observed them previously. Great Blue Herons often use the same nests year after year, adding to them each season. After watching with binoculars for a while, my brother, Frank, and I hiked to the place, bringing a roll of monk's cloth and a pocket knife with which to build a blind. The whole hillside and all the trees abounded with poison oak. Fortunately neither my brother nor I were subject to this vine, which clung to the trees so tightly that we used it in pulling ourselves up the trunks to the first branches.

We climbed every tree in the area and inspected all the nests. Finally we found one which we could photograph. It was almost at the top of a live oak, which was covered with wild clematis in full bloom. This native vine bears a profusion of creamy-white blossoms early in the spring.

Approximately 40 feet away—and higher up the mountain—was another oak about 70 feet high, which grew at a slant from the hillside and was fairly easy to climb. In the very top of this tree we constructed a blind, in a manner which let the leaves of the tree hide most of it, except for a small part of one side which faced the nest tree. After estimating an approximate location for the camera, we cut some slits in the monk's cloth for the lens and departed.

On our return a few days later,

there were five pale blue-green eggs on the bare twigs and countless small sticks that comprised the lining of the nest.

Both parents took turns at incubating, and by the beginning of April there were five hungry youngsters clamoring for food. Each parent al-

ternately fished and fed the downy babies. From our blind we could hear a constant "*tsk-tsk-tsk*," which seemed to be a cross between a croak and a grunt emitted by the young.

On April 7, 1941, I arrived alone, since my brother could not accompany me. Early in the morning, on the road



➤ THE FEET are let down in preparation for landing: a heron coming in to the willow tops near a lake



▲ WITH A LOUD CROAK, the bird settles on the nest

► AT THE EDGE of the nest the parent raises and lowers its neck a few times . . .

below the nest tree, I collected my equipment, which weighed about 50 pounds, and started to climb the half-mile to the tree. As soon as I left the road, all the herons in the vicinity disappeared. After crawling through underbrush and wading in about 18 inches of water and mud along a small canyon, I reached the base of the tree in which the blind was built. Because I was alone, I tied one end of my light rope to the camera case and, with the other end in my mouth, climbed the 70-foot tree.

I pulled up the camera, assembled it, and bolted it to the previously constructed base in the blind—then waited.

In about three-quarters of an hour the great birds returned to the hilltop above me, surveyed the situation, and glided down to their respective nests, with their long legs trailing behind and their necks folded to rest on their backs. Soon one of the herons from the nest I was photographing returned. When directly above it, the bird emitted a loud croak, dropped its legs, and alighted. Meanwhile, the young, upon hearing the croak, immediately ran to the opposite side of the nest and covered to avoid being hit by the parent's feet. As soon as it folded its wings, a clamor rose which did not cease until the young birds were fed. The large bird stood for a few minutes on the side of the nest, and then, after raising and lowering its head a few times, it regurgitated several small fish and one large bass. It presented each bird with a small fish, and then again swallowed the large bass itself.

As the young grew, they were fed less and less frequently until, when they were a month old, they received only two meals a day.

Soon they began to lean forward and lift their wings, gradually strengthening them until able to fly—for, once they leave the nest, young herons must fly all the way to the feeding grounds, which are often sev-

► . . . AND REGURGITATES several small perch and a large bass, which may be seen in the throat and bill. Black bass weighing about a pound and a half have been regurgitated by herons





◀ THE BIRD WATCHES over its 3-day-old babies while waiting until the food is suitable for their needs. A few minutes after this photograph was taken each of the five downy young were fed

eral miles from the heronries, or they might possibly be eaten by some predatory animal.

I remember vividly the time I arrived at my blind early on a cloudy morning. I waited four hours for the sun to come out without making a shot. Finally it cleared, and I got ready to take some color pictures. While I was waiting for the birds to return, the wind began to blow and did not abate until too late to make use of color film, because the motion of the tree made the use of a slow shutter speed impractical. I left at five o'clock with no photographs, feeling as though I had been out on a stormy sea.

Another day it rained soon after I arrived, and the sloppy wet material of the blind proved so annoying on my neck and back that I left without waiting for the sun to come out.

About June 10, the herons all left the nest and flew down to the marshes surrounding the lake, where they soon became expert "spear fishermen." Here in the shallows they would stand motionless until a likely fish or frog came within reach. Then, with a quick movement of the long neck and strong beak, they would make their catch.

On my last day there, I packed my equipment and drove around to the eastern end of the lake. Across the water the setting sun blazed a crimson path, and to the right, near some cat-tails, stood one of these solitary birds waiting for its evening meal. As I stopped and trained my binoculars on it, it caught a small perch, swallowed it hastily, and then returned to its rigid stance. Across the lake a Night Heron squawked, and as the last rays of the sun were reflected on the clouds, the Great Blue Heron flew out to the willows to roost for the night.



◀ THIS YOUNG HERON is about two months old and is just learning to fly. He is largely a fish eater, but in the course of his life he will also consume many large insects such as grasshoppers and locusts, also field-mice, shrews, and ground squirrels

The Modern Nature-Faker

Before some trust is lost in the printed word, it is time to point out that a great many tall tales and misleading statements are being published as fact

By WILLIAM H. CARR

*Director of the Bear Mountain Trailside Museum,
Associate Curator, The American Museum of
Natural History*

BIRDS and animals cannot sue for libel or refute exaggerated or untruthful claims. There are many among our citizens who wish this were possible. A growing number of animal stories and nature news items, circulated by some of the country's leading publications, cause the Spirit of Truth to cast down her eyes in confusion. For some obscure reason, certain writers seem to believe that where an animal story is concerned "anything goes."

Forty years ago, Theodore Roosevelt and the American naturalist, John Burroughs, initiated a campaign to insure truthful nature accounts in the press and magazines of the day. The then famous *Outlook Magazine* and several other leading periodicals championed the crusade. The words "Nature-Faking" were thrown back and forth, and names were named.

Today the situation is rapidly going backward and thousands of professional and amateur naturalists who read accounts of out-of-door events have learned to say, "It's only a story. I'd like to know what really did happen!" By inference one naturally wonders about other stories, too.

Certain types of misinformation easily become embedded in human lore. From the early days of civilization, experience has repeatedly demonstrated that when a nature-faking story gains firm foothold and consequently wide acceptance, the truth faces a long, hard struggle to re-establish itself in the popular mind.

Some people still give credence to the age-old story of the ostrich that buries its benighted head in the sand to escape crafty enemies. Some believe that beavers build houses with

windows and with three floors connected by stairways. Unreasoning aversion directed toward harmless snakes, frogs, toads, salamanders, and others has been fostered by fictitious accounts for centuries. As a result many persons are miserable in the out-of-doors through needless fear of these creatures. Hysteria has been caused through groundless fear of bats. It is difficult to induce some people to believe that bats do not fly into one's hair and that all bats do not obtain nourishment from human blood.

Inaccurate nature narratives and articles are, unhappily, far easier to discover than to overlook. Not long ago one of our largest news services dispatched a photograph which was published by newspapers throughout the country, purporting to show an eagle which had "attacked" a four-year-old child, with the intention of carrying her far from her native fireside. The photograph actually showed a deceased osprey, or fish hawk,—not an eagle,—tacked across a fence. In the foreground was the smiling child and the brave rescuer with his gun.

The eagle-child-snatcher story has been circulated from times of antiquity. When the sources are carefully examined, these stories prove to be the brain children of imagination, or of misinformed individuals. The osprey is no more an eagle than a red fox is a wolf, and its main business in life is fishing, not child snatching. Furthermore, it has been proved that our eagles cannot fly with objects weighing more than approximately eight pounds. Hawks, eagles, and ospreys have been maligned for many years. It would seem that if a story were worth printing, it would warrant investigation.

A recent visitor to a Natural History Museum stopped before an exhibit of birds, pointed to a mounted

specimen of the woodcock, and said:

"Look Bobby, here is a woodcock. When he breaks his leg he makes a splint out of mud and grass and puts it on himself, just like a plaster cast. I read about it in a magazine the other day."

Bobby, not as gullible as his parent, said, "I don't believe it."

Bobby's grandfather might have read the identical story in another publication at the turn of the present century. Of course the boy was right. Woodcocks are not equipped mentally or physically to perform bone setting operations upon themselves. It was just another unoriginal nature-faking story reprinted again after forty years.

People are entitled to the truth, whether it relates to weddings, murders, war news, or events in the animal world. Millions of dollars of public and private funds have been spent upon institutions and societies entrusted with investigation, research, and dissemination of the truth as it relates to natural science. All would be glad to assist in checking stories and facts, photographs and picture captions.

Not long ago a leading magazine published a splendid series of beaver photographs. Many schools throughout the land were glad to include the pictures in classroom studies of animals. Unfortunately, the caption writer permitted four misstatements of fact to appear in the brief account accompanying the illustrations. One photograph pictured a beaver sitting in about three inches of water feeding calmly upon the bark of a small branch. The caption stated that the animal was swimming. One mistake could be explained, but there were three others in the same story, errors of fact concerning beaver habits. Apparently superficiality was to blame. If accuracy had been desired, one of

the largest natural history museums in the world, with well informed staff members ever willing to help in matters of this sort, could have been reached through the expenditure of a five-cent subway fare, or a phone call.

According to a member of the editorial staff of the magazine just referred to, the photographic beaver story brought a response from more than one thousand readers who wrote the editor calling attention to the mistakes. But there doubtless were hundreds of thousands who accepted all the statements as true. Sometimes this same magazine has consulted authorities regarding the authenticity of articles and photographs only to disregard the correct information thus obtained and publish wholly incorrect statements regardless.

Another nationally known magazine also sponsored an article which included, by actual count, twenty-three misconceptions and partial untruths, relating to beaver behavior. Many of these mistakes, in almost identical form, have appeared in print on other occasions. The everyday life of the beaver is so replete with true dramatic interest that it seems particularly inexcusable to repeat the old saws over and over again. There are excellent beaver books available, to say nothing of many dependable magazine and journal accounts, all easily obtainable by the alert editor or writer.

The article, among other things, stated that "Nature forgot to teach the beaver how to fight." It is true that beaver are, in the main, docile animals; however, we have seen beaver attack their fellows viciously, making deep cuts about three inches in length. Beaver we have handled often do their best to sink their long teeth into any available flesh. Here is a brief paragraph from this article, which is typical of the entire piece.

"Make a break in a beaver dam and the reaction is prompt. Suddenly a brown head breaks through the water near a lodge, and the beaver swims unerringly to the point of trouble. Surveying the break thoughtfully, he slides down into the hole and goes to work."

The truth is that one may break a beaver dam in midmorning and often wait until after dark before a beaver appears. The "brown head" rarely "breaks through the water" anywhere near the lodge. On the contrary, the animal swims for a considerable distance from his home before

surfacing. He seldom "swims unerringly to the point of trouble." Instead he swims along parallel to the face of the dam, from one end to the other, often passing the actual break several times before going to it. He is suspicious and wary. After "surveying the break thoughtfully," he departs and returns with repair material. There would be no point to his "sliding down into the hole and going to work," for he would ordinarily have nothing to work with.

This paragraph is a monument either to faulty field observation or no observation at all. Errors of this sort do mislead people.

Sensational "nature stories" are a favorite with certain Sunday newspaper supplements and represent perhaps the acme in unadulterated fiction stories offered as fact. Witness the recently published tale, complete with artist's illustration, of a dolphin which rescued a two-year-old child near the Falkland Islands. It was related that the child, when playing on a beach, was swept into deep water by a huge wave and given up for lost. Fifteen hours later, the Captain of a cutter, "explained that he had sighted the baby in a mist six miles off shore." The rescuer at once lowered a boat and, "as the men were pulling toward the baby, [they] saw that it was being carried on the streamlined head of a Dolphin." After the little girl had been taken into the boat, "the Dolphin cut a wide circle . . . and followed for at least five miles."

To anyone who stops to think, this account is obviously incredible. Dolphin or no dolphin, it would hardly be possible for a two-year-old child to remain alive for 15 hours in the cold waters of the Falklands. Even if we concede a possible interest on the part of a dolphin for a human baby, the animal has been described as accomplishing the impossible. Yet a large percentage of the several million persons who saw the newspaper in which it appeared probably swallowed the story, hook, line, and sinker.

It sometimes seems strange that naturalists do not more often rise up in protest against the lawless invasion of their territory. Perhaps they feel overwhelmed by the mass of material and have become inured to it. An exception is Dr. Willis J. Gertsch, Associate Curator of Insects and Spiders, of the American Museum of Natural History, who became suspicious of statements in the press and

in various journals claiming that silk produced by the Black Widow Spider was in great demand for use in bomb sights and other military sighting instruments. Being a leading authority on spiders, he naturally wondered how the delicate strands could serve in this strenuous capacity, and particularly why the Black Widow's product was the most desirable. He made inquiries among a group of optical manufacturers and discovered that etched glass was used in optical fire control devices. He was told that spider silk is too fragile for these purposes and that the thread could not be adapted to the varied and complex needs of such instruments. He also ascertained that the silk spun by other species of spiders was used oftener than Black Widow silk in other types of optical instruments and that filaments of platinum wire were considered superior to spider silk.

Of course, the bite of the Black Widow is dangerous and the selection of this spider as the principal character created a fine story, replete with thrills. Once again facts were thrown into the discard in favor of sensationalism.

Another type of newspaper account is the "cute" variety. There was one about an attempt by a ground keeper to prevent a hungry group of deer from destroying plants in winter. The animals, driven by snow, cold weather, and lack of food elsewhere, invaded the carefully landscaped precincts of a garden and ate the leaves and buds of some valuable plants. In an effort to discourage the deer without taking more drastic action, the gardener placed naphthalene moth balls in small bags and hung them from branches throughout the garden. Sadly enough, the experiment did not succeed, and that was all there was to the story so far as accuracy was concerned. But right here is where the inventive reporter decided to "improve" upon the incident. Said he, "Instead of shunning the place, the deer began flocking to it in whole herds to await their turn in line to scratch their backs against the bags. It seems that moth balls and naphthalene have an inhibiting effect on deer cooties."

This type of fiction is doubtless very comical, but it is fiction nonetheless and only too frequently has the effect of discrediting the entire story and exposing to ridicule the unfortunate individual or institution supplying a truthful account of an

actual happening, in all sincerity and with the best of intention.

This tendency of reckless journalistic abandon which leads to the deliberate falsifying of animal and bird news accounts to "make a better story" is all the more deplorable when one considers that a factual, intelligent, narrative of actual happenings, imaginatively presented, would easily provide a story of equal or greater reader interest.

A peculiarity often observed alike in the press and in periodicals is the habit of some writers to attach far more importance to various events in the animal world than the facts could possibly warrant. Some authors apparently believe that the careless employment of superlatives adds weight to a story. Accounts of the presence of certain birds, mammals, or reptiles in a given area frequently declare that it is "The most important find in the past 20 years," or "The first of its kind ever seen," or "The largest specimen ever known." Usually the truth is that an honest observer has made an exciting local discovery which, in itself, would constitute a good story. No doubt this tendency to add great scientific importance where none is deserved may often be attributed either to overenthusiasm or to faulty information. Nevertheless, it is frequently an attempt to "sell a story" to an unsuspecting editor through the expedient of creating something that does not exist.

A newspaper of wide circulation recently published a story of a tame, captive woodchuck which, during an early protracted period of cold weather, refused food and slept continuously for several days, despite the fact that its cage was placed near a warm stove, indoors. It seemed strange to the woodchuck's owner that an animal which normally hibernates through the majority of the cold months, in its burrow outdoors, should enter into a dormant state regardless of the close proximity of considerable heat. The reporter, not satisfied with matters as they stood, declared that the animal had entered complete hibernation and would sleep until March "at least," and further indicated that the incident could be considered as a prediction of the severity of the winter to come. Incidentally, the woodchuck in question woke up on the day the story appeared, and ate a carrot. The "groundhog" story is hoary with age, yet it is trumped up every year.

Another category of nature writers includes the ones who invariably quote Indian guides, plantation workers, and others who frequently witness miraculous sights in the world out-of-doors. Readers would do well to beware of authors who state: "An old plantation acquaintance told me this story and I believed him without question. Wild turkeys do fly upside down sometimes."

There are the essayists who often lapse into prose such as: "Wild animals . . . possess that unembarrassed demeanor which is indicative of soul-poise, and manifest on many occasions a behavior that has the intellectual quality of good taste and fine preception." Why should animals be embarrassed in the first place? Would that some of our nature writers might exercise a bit of that "good taste and fine preception" in regard to accuracy. In general it is a good

F any reader would like to know whether a particular nature story is true or false, **NATURAL HISTORY Magazine** will be glad to try to give the answer.

—Ed.

plan to question those who continually endow animals with human psychology and interpret their behavior in terms of human motives.

Fanciful flights in the realm of literature are wonderful to behold, in their proper place, but, as truthful delineations of animal behavior, they drop swiftly from that high sphere where truth holds sway, falling with a sad splash into the black pool of things that might have been but never will be. It might be said that the "soul-poise" author once saw, nesting in a single tall dead pine tree, simultaneously: bluebirds, "black pileated woodpeckers," flickers, fox squirrels, screech owls, and sparrow hawks. What a busy tree that was! Fortunately many readers, through association with birds and animals and through the application of common sense, are able to "see through" considerable nature chicanery. This is cold consolation, nevertheless.

If accuracy is important in some

fields, it is important in all. Fiction is one thing but articles and essays that pretend to be true and are not are something else again. Everyone is perhaps entitled to a few mistakes. Nevertheless, knowledge of natural science has advanced tremendously in the last generation, and the popular writer has no excuse for riding roughshod over the truth when it has been so hard won.

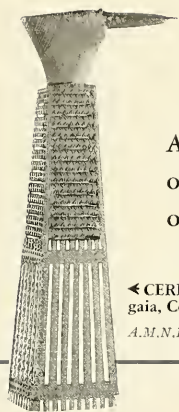
Recently the conscientious editor of one of our leading magazines, well aware of the nature-faking trend wrote: "The crime of publishing something that is untrue goes far beyond immediate events; and there is no doubt that if carelessness is allowed to go too far in this direction, popular trust in the printed word can be damaged in a dangerous way. The extent to which a controlled press can publish untruths and escape judgment is apparent in the axis countries. The free world has yet to see how very difficult it will be to restore any measure of trust among people who have been hoodwinked over a period of several years. Nature literature is only a small fraction of the whole, but every part is important in preserving the responsibilities that are inseparable with freedom of the press."

One particularly unfortunate result of the publishing of misinformation is that it arouses distrust in the minds of children concerning natural history and other subjects as well. Mistakes are discovered by keen-eyed youngsters and brought to the attention of teachers who thus have their faith shaken in publications which were previously highly regarded. Eventually the teacher's comments become something like this:

"Well, children, even though the magazine is wrong, we may all learn by finding the errors."

We have reason to be proud of our naturalists, many of whom, among other accomplishments, have unobtrusively helped technical divisions of our armed forces take long strides forward. Certain present-day writers do their profession small credit. There is a principle of fair practice involved here, which is concerned with placing trustworthy, honest products before the people, instead of bilking them with unsound material and cultivating a taste that can be satisfied only with miracles. Certainly all subscribers and purchasers, particularly children, are entitled to better treatment than this.

Peoples of the *PACIFIC*



By HARRY L. SHAPIRO

*Chairman and Curator of Physical Anthropology,
American Museum of Natural History*

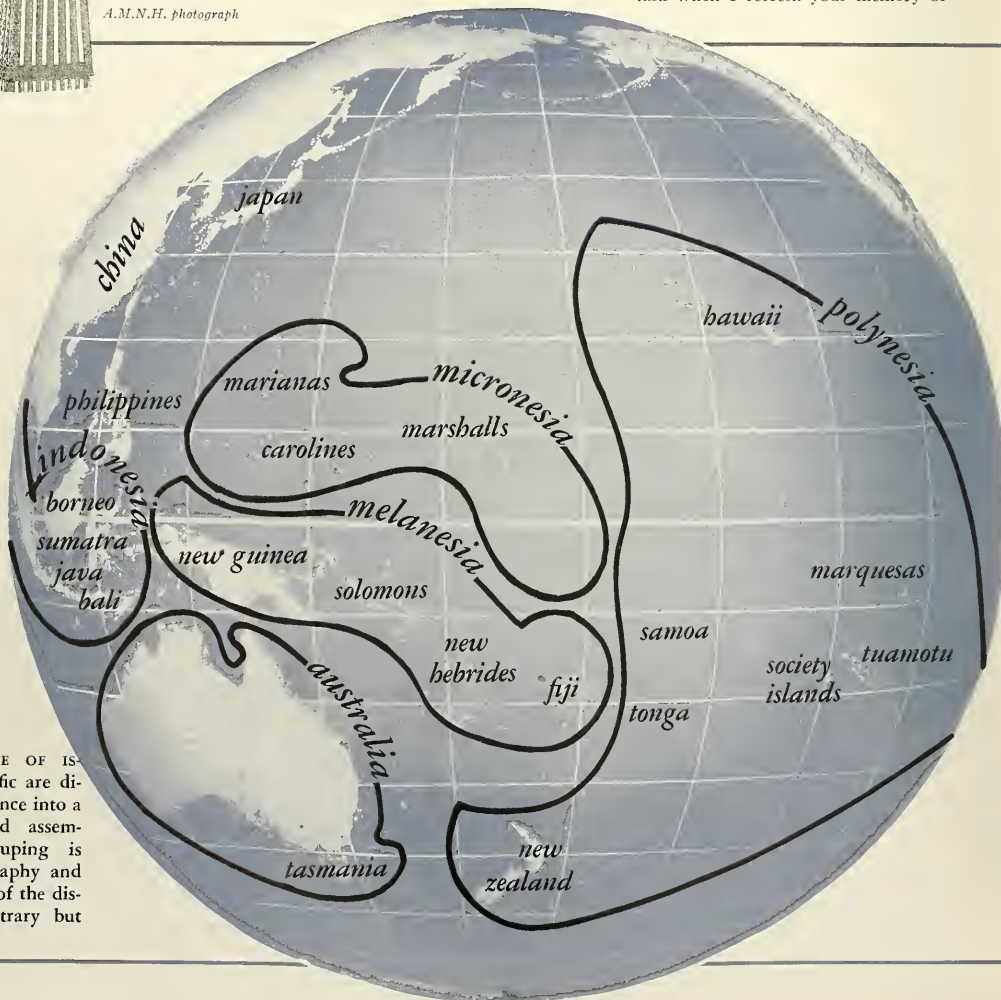
An introduction to the island natives
of a vast region that has become
of interest to every American

◀ CEREMONIAL ADZE from Mangaia, Cook Islands, in Central Polynesia

A.M.N.H. photograph

NEVER before in our history has our attention been so firmly focused on the Pacific. The intensity of our interest is natural when so much in our national and personal destinies is being determined there. Those of us who have dear ones fighting in the Pacific are, of course, especially eager to reconstruct imaginatively the kind of lives they are leading, to share, if only vicariously, in their experiences and to learn something of the people they will be meeting. To help you do this I shall try to tell you something of these people of the Pacific and their manners of living.

The problem of doing this adequately in a few pages is stupendous. It is like asking someone to describe in ten minutes all the varieties of race and custom to be found in the Western Hemisphere. I think you will better appreciate why it is so difficult a task when I refresh your memory of



► THE MULTITUDE OF ISLANDS in the Pacific are divided for convenience into a number of island assemblages. The grouping is based upon geography and population. Some of the distinctions are arbitrary but traditional

the vastness of the Pacific and the diversity of its people.

From north to south the Pacific is about 8350 nautical miles in distance. Its greatest width covers an even vaster distance. From Panama to the Philippines the distance is about 9300 nautical miles, or roughly three times the distance from New York to San Francisco. In this area which is greater than all the land area of the world put together, there are thousands on thousands of islands, some in thickly clustered groups or archipelagoes, others isolated and solitary—hundreds of miles from another speck of land. They range from huge islands that are continents or subcontinents like Australia and New Guinea to tiny coral reefs hardly rising above the surge of the sea. Some are rich in vegetation—actually jungles—, others are dry, desolate, and barren. On most of these islands native people may be found in



indonesia

a wide variety of types and living in cultures that run from the simplest forms to highly elaborate and complex civilizations—either native or European or Chinese.

Under the circumstances there is space only for a few important generalizations and a few characterizations.

You will notice that on the adjacent map of the Pacific between the Malay Peninsula and Australia lie a large number of islands large and small, closely studded and giving the appearance of a huge causeway connecting the Asiatic mainland and Australia. These, with the exception of New Guinea, constitute the East Indies. The Philippines, although not in a direct line, are essentially part of this island pathway, lying a little to the north and paralleling the Indo-China coast.

From this chain of close-set islands two separate branches emerge. The northern one, stretching eastward on

the level of the Philippines, is known as Micronesia and includes the Carolines, the Gilberts, and the Marshalls. The southern line begins as an extension of New Guinea and leads in a southeasterly direction. These are the Melanesian islands, through which our troops have been forging their way recently.

To the eastward the Micronesian and Melanesian lines converge and open into the Central Pacific, into a region of far flung and scattered islands known as Polynesia. These are the classic and romantic islands of the South Seas, the scenes of Herman Melville, of Stevenson, of Nordhoff

and Hall, and of *White Shadows*. New Zealand, which lies southeast of Australia and is isolated from the rest of Polynesia, is included therein because of the historical accident of its settlement by Polynesians. Hawaii, similarly separated from the central Polynesian area, lies to the north and belongs to Polynesia because its inhabitants were of the same origin.

Each of these geographic areas is characterized by people of different and distinctive racial origin and diverse cultures. Even within these large groups, minor local variations exist which make it difficult in certain respects to be dogmatic about the entire

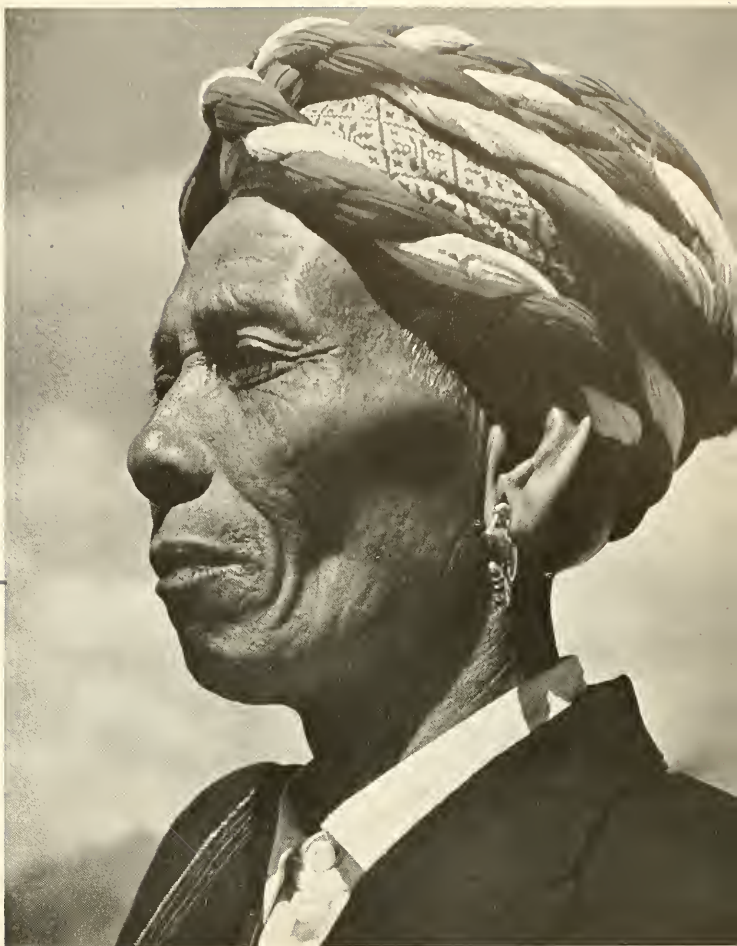


Photo by courtesy of Claire Holt

▲ THE DOMINANT PEOPLE of modern Indonesia are the Malays. Physically, their Mongoloid affinity accounts for their resemblance to Chinese and Filipinos, among whom similar or related types are found. This is a chief from a district in the northern coast of Sumatra

australia



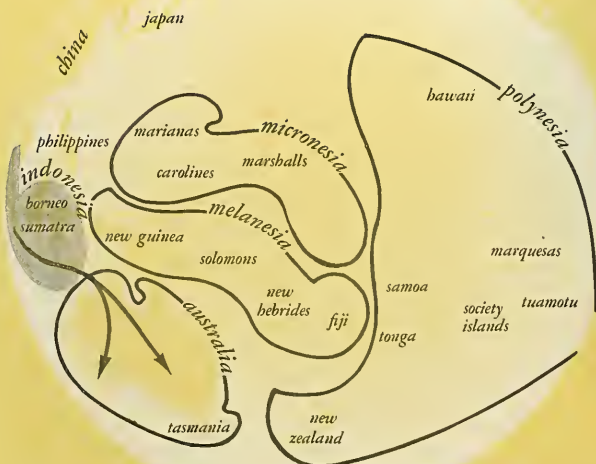
MacMillan photograph

▲ THE BROAD NOSE, heavy brows, and keel-shaped skull of this patriarch of the Arunta tribe are typical of Australian aborigines, who represent an early stage in human evolution

▼ AUSTRALIA was settled by an early migration, probably from Java, where a primitive human type similar to the Australian aborigine is known to have existed

region. It is important, however, to keep in mind the geographic relationships of these island areas since they explain the distribution of the various races to be found in this part of the Pacific. In the first place, they all connect up with southeast Asia, particularly the Malay Peninsula. It is almost as if the Malay Peninsula were like a funnel through which people have passed into the islands beyond, spreading out as they moved away. But on the eastern extension of these islands they fall short of America by two or three thousand miles. We have every reason to believe that all these islands have been settled by migrants from Asia in a number of distinct waves at diverse epochs in man's history. Any connection with America if it ever existed was of minor significance.

Next, you will notice that the islands of Micronesia and Polynesia are small and widely scattered over



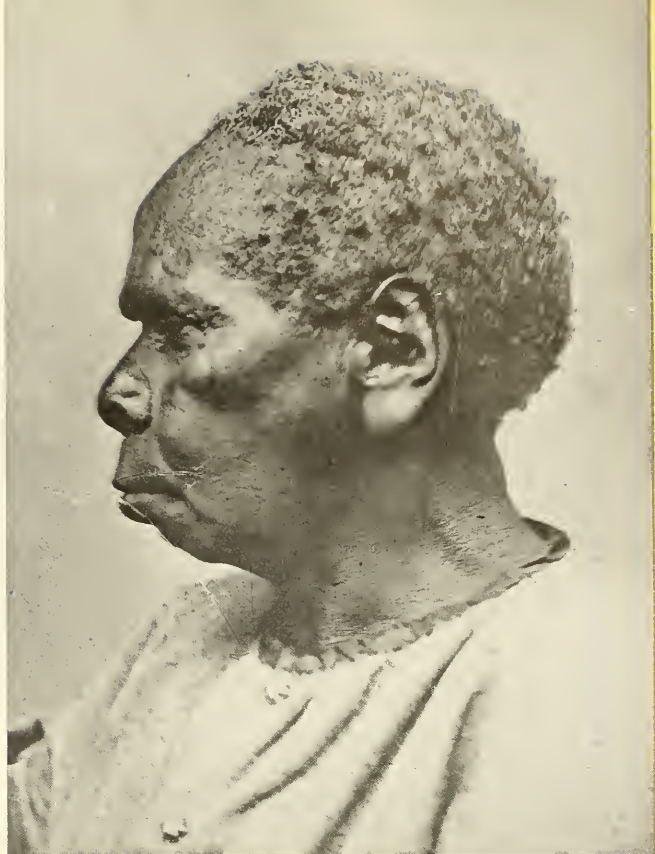
Their lips are moderately full, and their noses are on the thick side but not flat. They are distinctive and easily recognized among the other islanders of the Pacific, so that by definition the islands they inhabit are known as Polynesia, regardless of distances and geographic differences. These islands extend from Hawaii on the north to New Zealand on the south and from Samoa and Tonga on the west to the Marquesas and Easter Island on the east. Most of the romantic ideas about the South Sea islanders cluster around these people. I have spent a considerable amount of time with them. I have lived and sailed with them for days and months. They are hospitable, kindly, sympathetic, and intelligent. Any American who knows them well finds their racial difference no barrier whatever to close and satisfactory friendship. They appreciate kindness and more than re-

tasmania



turn in their own way any service you render them. On one island where I had been doing some scientific work I had occasion to nurse a young man who had been suffering from a severe infection. Fortunately I was able to help him from my store of medical supplies. His family was so grateful that for some months, in fact during my entire stay on the island, they brought to my door each day an ample supply of drinking coconuts and fresh fish whenever it was available. They wept on my departure and on revisiting them four years later I was greeted as an intimate member of the family.

The culture of the Polynesians as it used to be has now disappeared from most of the islands. The influence of European and American visitors was profound and rapid. Missionaries replaced the ancient rites by Christianity. Traders brought in tools, cloth, and various manufactures, causing the traditional crafts to languish and die. Nevertheless, much of the old customs still survives away from the ports, and to the discerning eye and the inquiring mind a rich heritage of former days may be revealed.



Beattie Studios photograph, Hobart

▲ THE NATIVES OF TASMANIA, now extinct, differed from Australians particularly in hair form. They are sometimes considered to be an early and isolated form of Melanesian. The last of the Tasmanians died in the 1870's

Two of the most obvious elements of native life in Polynesia are coconuts and fish. Polynesians are great fishermen, and much of their diet comes from the sea. They were so adept at fishing that they have retained almost unchanged their fishing gear. Nothing we could offer was as good for the purpose. The coconut tree enters deeply into the economy of the Polynesian, as it does elsewhere in the Pacific. From the dried meat of the nut they make copra—their most important cash crop. From the fiber they make cord; from the fronds of the tree they weave baskets, sun shades. Their houses are sided with coconut leaves. The shell of the nut is used for containers. They drink the water of the nut and eat the meat at various stages of ripeness.

The Polynesians had in former days a very rich and poetic oral literature, made up of religious chants, legends, creation stories, and mythology. Some,

of this still survives. But almost nothing remains of their elaborate social organization. The hereditary chiefs are gone. The great religious structures are now dilapidated and overgrown—sad reminders of a vanished state.

Moving westward toward Asia we traverse three distinct cultural areas—Micronesia on the north, New Guinea and Melanesia to the south, with Australia just beyond Melanesia. Australia is the home of one of the most primitive races of man now living. This is the Australian aborigine, now largely confined to the central desert. Just south of Australia is Tasmania, where another primitive type of man existed but is now extinct, having been exterminated by the 1870's as the result of the contact and encroachment of English settlers.

The Australian aborigine, numbering some 10,000 individuals, is primitive physically, with a narrow shelving

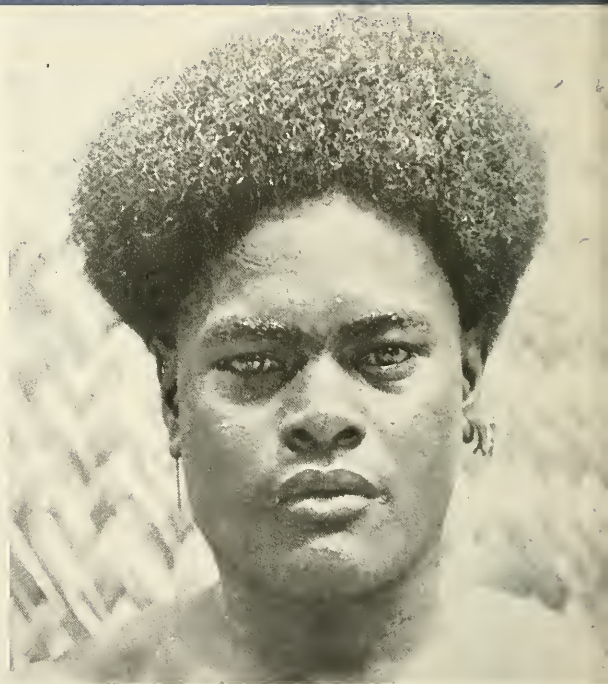


▼ THE NATIVES OF NEW GUINEA present a wide variety of types. The one below at left is from Mt. Hagen, a little known district in the interior of central New Guinea.

▲ MELANESIANS are sometimes classified as Oceanic Negroes. This Solomon Island man with his mop of fuzzy hair is representative. Melanesian Islanders are frequently employed on large plantations run by Europeans. In the old days they were impressed into service against their will by "black birders"



Photo courtesy of M. J. Leahy



Photograph by H. Ian Hogbin

brow and strongly projecting face. He is almost black in color and has wavy hair abundant on head and body. His equipment of tools and gear is simple and restricted, although he has the remarkable boomerang. His life is harsh and precarious. Clothing is scant or absent, and shelter is at a minimum. He is, however, noteworthy among anthropologists by virtue of his highly complicated kinship system regulating marriage and his reputed ignorance of the facts of life, at least some of them. The role of the father in reproduction is not understood by these people.

The Melanesians and the natives of

New Guinea may be grouped together in spite of distinctions which are commonly drawn among them. They are a dark brown people, usually having frizzy hair, broad flattish noses, and protruding faces. They are sometimes called Oceanic negroids because of their resemblance to African Negroes. Pygmy people of unknown origin live in the interior of New Guinea and the New Hebrides. These are the people whom our soldiers are meeting now in the Solomons, in New Britain, and New Guinea. By our esthetic standards of physical beauty they fall far below the Polynesian, although

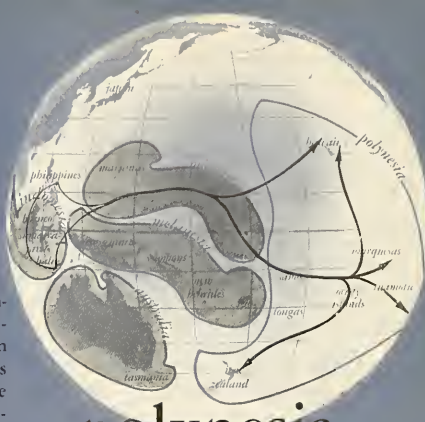
many of them are strong and robust.

The Melanesians as well as the Australian aborigines were not as highly developed in the nautical arts as the Polynesians, which accounts for their inability to move beyond their present island homes. To reach these islands, no great skill was required, since they are large, high islands, often within easy reach of each other. Thus even with primitive means of navigation the natives could reach their present settlements. They probably represent an early migration from more westerly islands, moving eastward under pressure of invading forces.



▼ THIS NATIVE of the Gilberts in eastern Micronesia (*lower left*) is quite unlike the characteristic type of the western Micronesia population, where Malay influence has infiltrated

➤ **POLYNESIANS** are the latest comers into Oceania and have migrated farther into the Pacific than any other people. The Marquesas Islands, the home of this man, lie on the easternmost limit of Polynesia. The maps in this panel show the successive migrations



Melanesian culture and language are highly variable. Students have found profound differences within short distances. These circumstances make it difficult to generalize for the whole group. Nevertheless, certain common features do occur widely in this area. A noteworthy decorative skill is especially interesting. It expresses itself on some islands in wood carving, on others in ritual objects and masks of intricate color and bold design. These ritual paraphernalia are associated with highly organized secret societies in which the entire community is involved. Indeed, secret societies seem



to have run rampant. The technique of the personal build-up also reaches unusual levels here in Melanesia. To acquire prestige some groups go in for complicated systems of giving away valuable objects, others by piling up mountains of food for huge feasts. The extreme development of the aristocratic and caste system formerly characteristic of Polynesia seems never to have evolved here.

Melanesian houses are generally simple one-room affairs, a cover of thatch over a light frame. Frequently the houses are raised on stilts, which makes a convenient dumping ground

available just under the floor. The pigs, which are ubiquitous, make good scavengers and keep the villages fairly clean. Many of these villages have a much larger building elaborately decorated for use as a kind of men's club, forbidden to the women, and as sleeping quarters for adolescent boys.

Gardening is a more frequent occupation here than in Polynesia. Gardens are an important source of food. The forest is slashed and burnt by the men, and the women take over, using a hoe culture. Some of the more important food crops include the leaves and starchy rootstocks of the taro, sweet



▲ FISHING is one of the mainstays of Polynesian life

MARQUESAN NATIVES cutting up a manta on the beach

Photograph by R. H. Beck, Whitney South Sea Expedition



▼ THE MEAT of the coconut, only cash crop of Polynesia's coral atolls, is dried and sold to traders

Photograph by Harry L. Shapiro



▼ TUAMOTUAN natives used to transport soil from Tahiti to make beds such as this for growing taro

Photograph by Harry L. Shapiro



Photograph by Harry L. Shapiro

▲ THE CLEAN CORAL sand makes excellent village streets. This village in the Tuamotus is like many others—coconut trees and sand. Modern houses are built of planks and roofed with tin

▼ FISHING is one of the arts of Polynesian life. Lines, nets, and traps were used. Most of the old fishing gear has survived European influence



polynesia

➤ ONLY IN THE REMOTE DISTRICTS do the older thatch roofed houses survive. This one is the home of the chief of Rapa. The thatch is commonly made of pandanus leaves, folded over the midrib of a coconut leaf

Photograph by R. H. Beck, Whitney South Sea Expedition



Photograph by R. H. Beck, Whitney South Sea Expedition

◀ THESE RAPA GIRLS are paddling home from the taro fields which are some distance from the village. Taro is an important food plant throughout Oceania. Fermented taro makes one form of poi—a widespread native dish

▼ THESE NATIVES OF RAPA gather on the jetty to welcome or to speed their guests. The isolation of the island lends a special festivity and excitement to the arrival of any visitors

Photograph by R. H. Beck, Whitney South Sea Expedition ✓



australia

◀ AUSTRALIAN ABORIGINES are largely confined at present to central and northern Australia. Their number is estimated at around 10,000. This Kaitish man has a typical hair-do and a slit nasal septum for holding ornaments

▶ THE POVERTY AND SIMPLICITY of Australian life is suggested in this picture of an Arunta woman and child. Clothing is scanty or absent, equipment simple, and shelter at a minimum

▼ ALTHOUGH THE MATERIAL ASPECTS of aboriginal life in Australia are severe and primitive, their social and ceremonial life have some highly evolved elements. The ceremonial episode below depicts a thalaualla (black snake) drawing on the ground, with participants in full regalia. Some of the men are wearing elaborate head dresses. Their torsos are covered with feathers stuck to the body with human blood. The celebrants belong to the Warramunga tribe



Photograph by Spencer

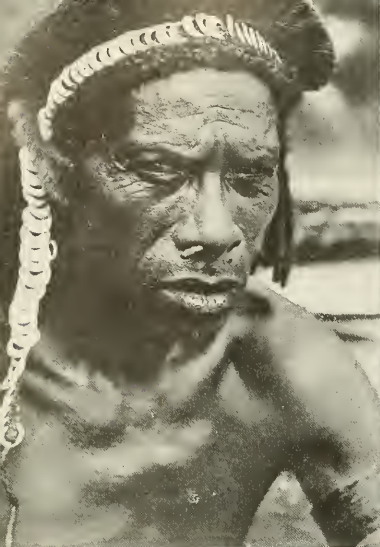
potatoes, yams, pumpkins, squashes, bananas. Pigs and small game furnish most of the flesh foods.

Speaking of food reminds me that some of the Melanesians are notorious for their addiction to human sources of meat. Cannibalism until quite recently was not unusual in some of these islands. When I was on Norfolk Island in 1923 we received reports of the murder of several missionaries in the New Hebrides who were eaten by the native tribesmen. Although this vicious practice had been associated only with the Melanesian, it formerly was more widely spread and was known to occur even in Polynesia. On a visit in 1929 to the Marquesas in eastern Polynesia I met one old man who told me that as the son of the chief he was entitled to a finger of the victim, a morsel which he recalled as tasting quite good. Within



▶ THIS GROUP of old men were in charge of a tribal gathering held at Alice Springs. Each of them is the head of a totemic group. The shelter is constructed of boughs





Photos courtesy of Capt. Frank Hurley

▲ A NATIVE of New Guinea. Decorations and hair-do vary from tribe to tribe



▲ THE MEN'S CLUB HOUSE: usually an impressive part of Melanesian and New Guinea villages



▲ THE LOVE OF FINERY is universal. These native girls are adorned with flowers, seed necklaces, and shell ornaments



◀ A MANUS CHIEF paddling his outrigger canoe. Manus is one of the Admiralty Islands recently captured by our forces in the Southwest Pacific. The native village on Manus is built on piles standing in a lagoon

Photograph by R. H. Bech, Whitney South Sea Expedition

melanesia



◀ IN THIS ROW of boathouses are lodged the large canoes drawn up on the beach. The canoes are seaworthy enough for long voyages and are characteristic only of a limited part of the Papuan Coast of New Guinea

Photo courtesy of Capt. Frank Hurley



Photo courtesy of M. J. Leahy

▲ THIS VILLAGE, set among the mountains of the interior of New Guinea, was only recently discovered. It is an unspoiled example of native life, untouched by European influence

➤ THE RARITY of a European spoon in central New Guinea endows this lowly utilitarian object with the glamour of a jewel. The beard is apparently dense enough to hold the spoon

▼ THE MINT on Malaita, in the Solomons. Shells cut into discs and strung on fibers constitute money for these Melanesians. The process of manufacture is long and laborious

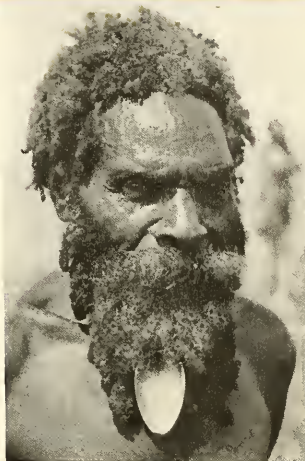


Photo courtesy of M. J. Leahy



the past decade, however, cannibalism has disappeared even in the remote islands of Melanesia.

Micronesia, which lies to the north of New Guinea and the Melanesian islands, includes the Marianas or Ladrones, the Palaus, the Carolines, the Marshalls, and the Gilberts. These groups begin to the east of the Philippines and continue along the tenth degree of latitude north of the equator, dipping south at the Gilberts toward Melanesia and Polynesia. Less is known about the people of these islands than about the Polynesians and Melanesians. During the Japanese mandateship, visitors and scientists were rigorously excluded for reasons which are well known to us now.

Physically the Gilbert and Marshall islanders approach the Polynesians in appearance, and much of their culture has similar relationships. But the material poverty of their low coral islets has inhibited the development or maintenance of a rich culture. The Gilbertese used to be famous for their armor woven from coconut fiber and their weapons studded with shark's teeth. A high degree of maritime skill was also characteristic.

As one moves westward toward the Asiatic mainland and the islands of the East Indies, the physical type becomes progressively more like the Malay until in the Palaus, Marianas, or in the western Carolines the Malay infiltration is very marked. The influence is by no means confined to racial characters. Many Malay cultural elements have also greatly affected western Micronesia, yet are absent farther east. For example, the chewing of betel nut is common in western Micronesia but is unknown in the east.

The East Indies are commonly typified in our minds by huge islands such as Java, Sumatra, and Borneo. But there are many more than these few imposing islands. From Sumatra, hugging the west coast of the Malay Peninsula, to the eastern islands off the shore of New Guinea is a distance of over 3000 miles. Within these limits lie thousands of islands, mostly of volcanic origin. Here live 70 million people, over half on the island of Java alone. The Philippines, just north of Central Indonesia and adjoining Borneo, are sometimes considered apart from the East Indies. Their cultural and racial affiliations with Indonesia, however, are so intimate that aside from geographic reasons they should be linked with the East Indies.



Photo by C. H. Townsend

▲ THE GILBERT ISLANDERS were famous for their armor, woven from heavy coconut fiber. This warrior carries a shark-tooth weapon and wears a helmet made from the dried skin of the blowfish

micronesia

▼ THIS SCENE in the lagoon of Truk shows the local variety of outrigger canoe. Such craft are speedy and require skill in handling

Photograph by Albert A. Mayer, A.M.N.H.



Photo courtesy of Carl Lunnholtz

◀ SCENE ON THE KAYAN RIVER of Northern Dutch Borneo. The large Indonesian islands are almost continental compared with the small islands of Polynesia and Micronesia. As a result, Indonesian life is less restricted to a shore line occupation

▼ THE CULTURE OF INDONESIA reached high levels in pre-European times. Java was once a powerful kingdom with a complex civilization derivative in part from India. This relief cut in stone is part of the famous temple at Borobudur in Java

Photo courtesy of Claire Holt



indonesia





Photo by Jessie Tarbox Beals

▲ MANY OF THE FILIPINOS are Malay in origin, although traces of other races have survived. These Bagabo warriors are representative of the prevailing Malayan strain

philippines

▼ THOUSANDS OF MILES of stone retaining walls are required for the construction of these terraced hills, one of the most remarkable engineering structures in the Philippines

Courtesy of Bureau of Insular Affairs, War Department, Washington



The people at present dominant in the East Indies are the Malays, who constitute a branch of the Mongoloid group of mankind. They are short, often muscular, with straight black hair, brown skin, a broad flattish face, full, somewhat bulbous brow, and moderately thick lips. The Javanese are of this type. The highest developments of native culture are generally associated with the Malays.

An earlier invasion of Malay people sometimes called Proto-Malays with less obvious Mongoloid traits is now represented by people living in the interior of the large islands of the East Indies or on the remoter small ones. Traces of earlier populations that once lived in these islands can still be found scattered throughout the region. The primitive Australian aborigine must have passed through these islands on his way to Australia. Although little trace can now be discovered of him, there is much more evidence of his successor and follower, the Melanesian, who still reveals his presence in the population of the eastern islands of Indonesia. Pygmies similar to those found in Melanesia still survive in the Philippines. It is worth recalling that in the remote past one of the earliest and most primitive human types existed on Java. This is the famous *Pithecanthropus erectus*, whose fossil remains are dated as far back as a million years.

It is impossible to characterize the pattern of life in this area, as it varies enormously. Some cultures are quite simple and reminiscent of those we have already described. Others such as the civilizations of Java, of Bali, and of Sumatra, are highly organized, complicated societies with elaborate political and religious structures, magnificent art and architecture, native music and dances of extraordinary development, and a multiplicity of exquisite crafts and manufactures that bear comparison with our own. Indonesia is in reality a region where high civilizations have flourished long before the advent of the white man. It has had long and intimate contacts with the civilizations of the mainland: India, Malaya, and China. For centuries these islands have been the principal goal of Chinese emigrants, who were firmly entrenched in the commercial life of the islands. From these islands came at least one of the major elements in the Japanese population, and traces of this origin are still plain in Japanese culture.

▼ CONES like these which dot the landscape led an imaginative observer to dub the region, "Craters

of the Moon." Big Cinder Butte, the highest point in this area, may be seen in the distance



U. S. Geological Survey photo

Cinder cones, perpetual ice, and blistering heat make Idaho's Craters of the Moon unique among the nation's wonderlands

By KEITH BARRETTE

THE water bubbling from the mound of basaltic sand was ice cold. It was so cold it made your teeth and jaws ache to drink it. But the sand from which this crystal spring gurgled was hot. Too hot for comfort.

In Idaho's Craters of the Moon National Monument, paradoxes such as ice water from hot sands are commonplace. Located in the central part of the State, 22 miles south of the little town of Arco, the Monument is included in an area that is the result of the most recent fissure eruptions in the nation.

The old-timers who swarmed into the Lost River Valley in search of gold and grass called the region, "the tail end of creation." Not understanding the volcanic origin of the place, they believed it to be the final corner of the earth to be created.

Their guess, in a sense, was disturbingly accurate. Geologists of a later generation have agreed that this great, charred vista of lava fields is the result of eruptions occurring within the past few hundred years. Some scholars

divide these occurrences into three periods: the first about 700 to 1000 years ago and the last and most recent about 150 years ago. The second series of outbursts are placed about half-way between the first and third.

The relative infancy of this volcanic area is further attested by the presence of "surface bloom" on some of the lava flows. The "bloom" is totally absent from flows known to be much older. This "bloom" is a bluish glaze, a gloss which resembles the polish that mother used to give her newly baked bread by brushing the loaves with milk just before popping them into the oven.

In the beginning, this bizarre world of tumbled lava, leering craters, and weird formations was a green, lush, and slightly rolling plateau. In luxuriant meadows that carpeted it, deer and antelope grazed. At night they bedded down among the trees that covered the slopes and hillsides. Several rivers and streams ambled across the scene on their way to join the waters of the Snake River.

Today, these streams are vanished,

and between the northern boundary and the southern edge of these lava fields—a distance of 200 miles—not a drop of water reaches the Snake River through surface channels.

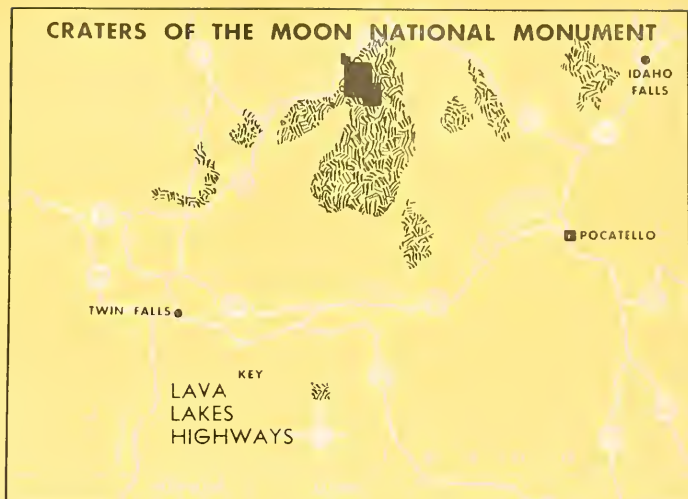
Southeast of the White Knob Mountains (a chain of hills west of the mining town of Mackay), fissures began cracking the face of Mother Earth. These crevices comprised a general rupture, later known as the Great Rift, which runs parallel to the Rocky Mountains. Deep below, pockets of molten basaltic rock were simmering and seething, the while gas was exerting a tremendous pressure against the retaining walls.

As the molten mass moved upward, the restraint grew weaker, until at last, with a terrific, gushing roar, the gases suddenly found escape. Streams of flaming lava spewed forth and traced mill races of fire across the once peaceful plateau.

Sometimes obstacles divided the molten current, and it sent out arms, groping paths in divergent directions. Again, one swiftly moving flow would overtake another and the two would swell into a torrent which consumed everything in the way.

Among the victims of this volcanic blitzkrieg, were the green groves that dotted the plateau. Cottonwoods, aspens, and piñons could not halt the forward sweep of the lava. Entire tree trunks were engulfed by the

Tail End of Creation



burning tide, and the intense heat soon reduced them to charcoal. Where once these trees stood, now stand tubular molds, with bark patterns deeply impressed into the inside walls.

Fragments of rock, dust, and lava were hurled hundreds of feet into the air by the explosions, scattering debris for miles in every direction. After this first outburst had relieved the subterranean pressure, the volcanic ac-

tivity subsided until more gas accumulated and demanded outlet. With each explosion, the flows spread more and more widely, until at present more than 200,000 square miles of Idaho are covered with black lava.

As a result of this spectacular activity, the geography of the plateau was changed from one reflecting the piety of Nature into one of desolation and violence.

Spotting the landscape, like a black pox, are the "blowholes," or fumaroles. These were formed around al-

▼ GROTESQUE PATTERNS are made by these "ropey" folds in the major lava flows. The molten rock poured forth when long pent-up gases suddenly burst through the surface in an upward surge

Photo by the author



▲ A VISITOR examines a block of vesicular lava. The fragment is dark on the surface and a dirty salmon inside. Its many large holes give it the appearance of a petrified sponge

➤ SIXTY-THREE lava and cinder cones march out of sight into the desert haze that covers Idaho's lava fields. The presence of trees and flowers here belies the story that the lava fields are devoid of vegetation



U. S. Geological Survey photo

▼ EARTHQUAKE CRACK crossing over a cone. Crevices like this are part of a general rupture, the Great Rift, which runs parallel to the Rocky Mountains. They are only one of the many spectacular volcanic features of this region

U. S. Geological Survey photo

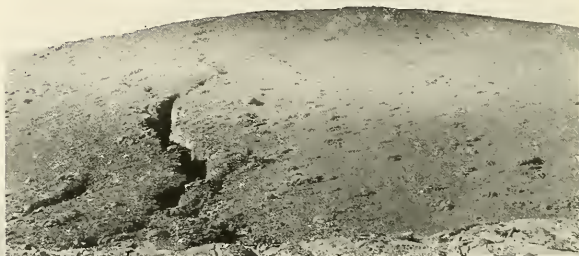


U. S. Geological Survey photo

▲ "THEY CUT DOWN THE OLD PINE TREE." This tree was 457 years old and had been dead only about two years when it was cut down in 1926

➤ A STALWART TREE once stood here; only this tubular mold recalls its presence. The eruption that formed the Craters of the Moon was so recent that the open fissures have not been filled with wind-blown material

Photo by the author



most every vent by the molten lava piling up around it. They have perpendicular throats from four to 20 inches in diameter and are rifled like a gun barrel. Soundings of a number of them have been attempted, but the plummet never touched bottom.

One amateur investigator dropped a gas lantern tied at the end of a rope into one of the fumaroles. He watched the white glow of the lantern sink deeper and deeper into the stygian gloom, until at the end of 200 feet of line a pin point of light continued to stare up at him, but the heavy cord was still taut in his grasp.

Kinds of cones

As the steaming lava poured from the numerous vents and flowed east, south, and west across the plateau, other craters were made. These craters or cones fall roughly into three classifications: cinder cones, consisting of piles of lava froth hurled up by the action; below; spatter cones, formed when clots of lava, hurtling upwards, spilled in a semimolten condition and adhered to one another; and lava cones, created by the lava welling springlike from isolated openings and running down the gentle slopes of the dome-shaped mounds.

Sixty-three craters, lava and cinder cones form a line of march, Indian file, two or three miles wide and 30 miles long, across this weird fantasma. Perhaps nowhere else in the United States are there to be found so many spectacular volcanic features grouped together in so small an area.

The abundance of these craters led some imaginative Romantic to dub the region, "The Craters of the Moon," because he thought it resembled the surface of the moon as viewed through a telescope.

In 1924, President Calvin Coolidge took cognizance of this strange country and caused about 80 square miles of it to be set aside as a National Monument to be known as, "The Craters of the Moon."

Prior to 1923 only cursory exploration had been made. The majority of the investigations were carried out by curious travelers, who studied the terrain more by whim than by rule. The ranchers had no occasion to explore the place, because it is practically nude of pasture.

Itinerant prospectors had no reason to venture into such a forbidding corner, because lava fields do not offer

paying quantities of gold or silver. True, a few reckless adventurers wandered into this wilderness, but their objective was the search for a legendary cache of silver bullion supposed to be hidden there by a wounded bandit after holding up a stage coach.

Superstition kept the Indians away. They believed the region to be the abode of various evil spirits and satanic devils.

But in the late summer of 1923, R. W. Limbert of Boise, Idaho, headed a party that explored a large portion of what was then called the Idaho Lava Beds.

However, there is still much of the region awaiting more thorough investigation. The major obstacle is the lack of water. True, in crevices and "sinkholes" water is to be found, but travel is hazardous without a foreknowledge of the location of these reservoirs. Many men have ventured out into the black expanse of desolation, but in almost every case thirst has driven them back.

Several years ago, a party of three men almost perished. They set out in high hopes to test the authenticity of a legend which said that somewhere a crystal lake of azure water sparkled in a setting of lava flows and craters. The group returned just as a searching party was about to set out to look for them. They straggled back to civilization haggard and half-crazed by the withering heat created by the unrelenting reflection of the sun against the almost unbroken sheet of lava. To increase their misery, the ruff, rasplike surface of the lava practically ripped the soles from their boots, and much of the return trip was made almost barefoot.

Eighty square miles is comparatively insignificant when viewed in comparison with 200,000 square miles. But in this restricted space there are enough volcanic oddities to keep the average horizon chaser busy for weeks. Innumerable caves and tunnels wander about beneath the lava flows and present a continuous challenge to the spirit of adventure.

Perpetual winds blow through some of these caves. Whence they come or where they go is still a secret wrapped deep within the inscrutable countenance of Nature herself. Other caves are eternal cisterns of water too cold to drink, while others are sheathed in blankets of ice that never melt even in the blazing noon of mid-sum-

mer. It is a profound paradox that what was born in the grate of volcanic violence should later be the fount of so much refreshment.

These subterranean passages were made by the formation of a crust on the outer layer of a flow while the core was still in motion. The basaltic center continued its fluid movement until the embryonic tunnel was emptied of its fiery viscera.

Big Cinder Butte

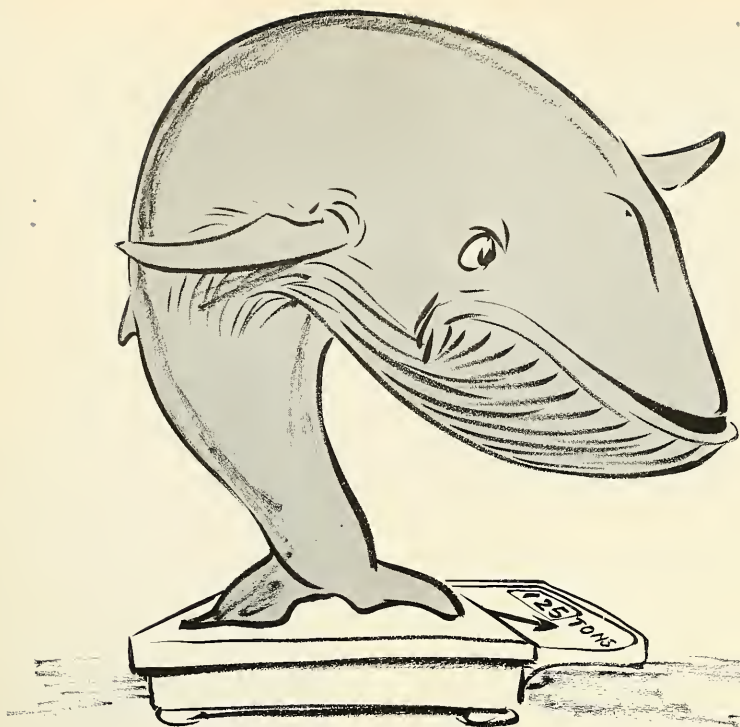
The highest point in this weird jumble of craters, fumaroles, and twisting lava flows is Big Cinder Butte. It is of reddish and black volcanic fragments and it is one of the largest basaltic cinder cones in the world. The slopes of the butte are splattered with lava "pancakes" and volcanic "bombs," which were thrown high into the air with a whirling motion and fell.

At one time, geologists estimate, Big Cinder Butte was probably twice as high as at present. A subsequent eruption, however, blew the "roof" from the cone and scattered this additional stature over the surrounding terrain.

Down the sides and on the bottom of the cone, piñons of several varieties are growing. Presence of the trees belies the story that the lava fields are devoid of vegetation. The truth is that lupins, wild geraniums, and myriads of other western wild flowers spread a blanket of color over their gloomy habitat during the spring and summer seasons. Despite the fact that the region is desert, no snakes have been found.

Visitors experience a variety of emotions when they visit the area. A sense of eerie loneliness grips some the first time they view this wonderland. Others gazing upon the geologic confusion have felt as though they had been suddenly transported from the earth and were standing upon the face of another planet.

But there is the story of one traveler, who visited the lava beds and reacted differently from all others. Silently he went from one phenomenon to the next, until at length, he stood upon the summit of Big Cinder Butte. He gazed at the broad, unbroken stretches of lava fields and looked down upon the belt of craters, all without comment. Presently he turned to his companion and said: "Extremely charred, isn't it?"



Normal Weight

By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON



WHEN an animal weighs more than 100 tons, we are likely to think it must be overweight, while an adult mammal one quarter of an ounce or less might be considered underweight and in need of building up. These are the weights of a large female blue whale, or sulphur-bottom, and the common long-tailed shrew.

On land, the largest living animal is the African elephant. Fully grown bulls of this species may weigh more than seven tons, although few get so large. The Indian elephant may weigh about five tons. Then come the hippopotamus and the white, or square-mouthed rhinoceros, weighing about three tons. An extinct type of rhinoceros was taller than any of the elephants, living or dead, but probably did not *weigh* so much as the extinct imperial elephants. They were probably the heaviest land mammals,—perhaps as heavy as any land mammal could be. On land, bones cannot become strong enough to support the weight of an animal as large as a whale, and there is a limit to the development of muscles that could move such a mass. In the water, support is no problem. Flesh and fat are less heavy than water, and water carries the greatest whale on its bosom as

easily as it does the tiny shrimplike animals on which the huge blue whale feeds—tiny creatures only an inch long and a fraction of an ounce in weight.

The largest of the dinosaurs was almost as long as the blue whale, but the slender neck and tapering tail account for most of this, so that the dinosaur weighed only about a third as much as the whale. It was not a land-loving animal, although it may have waded out onto the land for short distances. If its legs were able to support its great weight, it is doubtful that it could have traveled far enough overland to secure the necessary food, in spite of the reptile's low fuel consumption. One of the reasons the African elephant has not been used like the Indian elephant is that the former spends so much time eating to sustain its large size that it has little time left to work for man.

An individual animal in the natural state rarely becomes overweight. However, when a species reaches a large size it is in great danger of becoming extinct. The prehistoric record is filled with animals that started small and became large only to die out. There is safety in numbers, and small animals can be much more abundant than large ones. A famine is not as likely

to affect them seriously, for each individual needs only a small amount of food, and even if the population is reduced, some individuals remain to carry on.

The smallest North American mouse is the silky pocket mouse of the Southwest. It is usually a trifle heavier than a quarter-ounce, and the harvest mouse of the southeastern States has only a little more avoirdupois. The largest of the mouselike mammals found in North America is the muskrat; it usually weighs about two and a half pounds, but individuals may be a third heavier. Our largest rodent is the beaver, weighing 35 to 40 pounds, rarely as much as 65. The capybara or carpincho of South America and Panama is almost twice as heavy as a big beaver; it is the largest living rodent, and rodents as a group are mostly less than a pound in weight.

The smallest of our carnivores, or flesh-eaters, is the pygmy weasel; it weighs only about a quarter-pound. Our heaviest carnivore, the Alaska brown bear, may weigh more than 1600 pounds, and the polar bear can be almost as big. Although we call the lion "king of beasts," he is far from the heaviest meat-eater and weighs only about 500 pounds.

YOUR NEW BOOKS

OUTDOORS • ALASKA • MAP SCIENCE
OCEAN BOTTOM • BERING'S EXPEDITION

THE HIKER'S HANDBOOK

----- by Douglas Leechman

W. W. Norton and Company, Inc., \$2.50

HERE is a lucid, practical little volume on the art of walking, built upon years of experience in various parts of the world, and organized with skill, common sense, and humor. The literature of walking has grown steadily in quantity during the past decade, as added numbers of citizens learn something of the joys of following the open trail. While some of the advice is necessarily repetitive, this book will nevertheless take its place with the foremost works upon the subject. It is decidedly refreshing, stimulating, informal, and worth-while.

There is thoroughly adequate information on how to sleep in the open, what to wear, what to carry, and what to leave at home. Details concerning cooking, fire building, first aid, and similar matters are not intended to result in the training of professional cooks, lumberjacks, or trained nurses; on the contrary, an honest, straightforward attempt is made to assist the walker to be at home in the woods through the observation of elementary, well-founded woodcraft procedures. The book strikes a happy medium between the serious, weighty tomes which solemnly state that, "One way to keep the extremities dry is to wear rubbers," and the other type which provides detailed plans for building a log cabin, complete with balcony, when the perplexed reader merely seeks information on how to quickly construct a simple shelter to ward off the wind and rain.

It is stated that the walker may enjoy a day's outing along the seashore, over mountain trails, or upon the streets of a large city, provided he knows how to walk and how to plan the journey. The week-end pedestrian or the vacation walker who contemplates a somewhat extended expedition, will discover valuable hints, whether he is a novice or a veteran.

WILLIAM H. CARR.

ALASKA AND THE CANADIAN NORTHWEST

----- by Harold Griffin

W. W. Norton and Company, Inc., \$2.75

THIS is an eye-witness account of the stupendous achievements now in progress in the last outposts of American civil-

ization. It is the story of a colossal undertaking where the impossible is being accomplished, pressed by the necessity of war.

The vast wildlife sanctuary of the Northwest that up to now has defied human efforts, has at last been conquered by steel and man's inventions.

The author tells an amazing story of booming towns where a couple of years ago I saw nothing but a few forlorn huts. He writes of rich oil fields, gold, radium, and untold wealth in minerals.

The book gives a vivid picture of the new frontier which is being pushed forward by both American and Canadian efforts, since it cannot be separated geographically and embraces the area extending from the Mackenzie River to the Bering Sea and part of the Northwest Territories, northern Alberta, British Columbia, the Yukon, and Alaska. Mr. Griffin emphasizes the postwar possibilities and opportunities and the development of the country's wealth. He shows the advantages of the tremendous Alaskan Highway that is transforming the wilderness, and he takes you to the oil developments at Abasands and Fort Norman. He tells of his conversation with a prospector, old Bob Henderson, who said "Remember what I told you? I told you to forget all this nonsense about the frozen wastes of the north. The north isn't a barren land, it's just empty, waiting for roads and railroads, and people to build the country. And I told you not to spend too much time digging into the past. It's the future that matters."

This book, illustrated with sixteen photographs and a map showing highways, railroads, and mineral deposits, contains 216 pages of text and an index.

The author has been editor and writer for Canadian and American newspapers and publications. Since 1932, he has made a number of trips into the Canadian Northwest and Alaska, the most recent being late in 1943.

G. G. GOODWIN.

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Six Giant volumes, 8½ x 11½, 2,000 pages, weight 23 pounds. Lives and habits of 3,000 species of birds, mammals, reptiles and fishes described by world famous Naturalists; 1,000 species illustrated, 300 in natural colors; published at \$29.50. The Literary Mart, 411 West 125th St., New York, offers this set to members for \$19.50, returnable for full refund after 5 days' examination. Nature Encyclopedia edited by G. C. Fisher, 5 volumes with 200 colored illustrations, given free on orders mailed in April.

CIVILIZATION AND DISEASE

----- by Henry E. Sigerist

Cornell University Press, \$3.75

ALTHOUGH we have come to think of civilization as conquering disease, actually it has been responsible for many of the ills from which mankind suffers. Out of the growth of our cities have emerged the slums with their unsanitary, crowded tenements. Our industries have subjected workers to hazards that have led to well-known occupational diseases. Even the clothing that civilization has at various times decreed, such as the old-fashioned corset, has brought about unnatural organic conditions. Indeed, a complete list of the ways by which the by-products of "civilized" living may and do lead to disease and organic breakdown would cause one to wonder how mankind has ever managed to survive his own civilization. In some instances, it seems clear that man was in fact a victim. Only in the age of science has civilized man been able to cope effectively with the disease natural to his organic origin and induced by his way of living.

But disease has affected our civilization not only because of the efforts we make to combat it but also because its pervasiveness, its horror, its tragedy, and its terror have colored our thinking, our arts, our economics, our history, and our science. This relationship between disease and various aspects of civilization forms the subject matter of Doctor Sigerist's work. He has examined the diverse facets of civilization from two points of view: (1) as they have created a milieu for disease and, (2) as the phenomenon of disease has modified or conditioned the course and the activities of civilized men.

The record is a fascinating one, told in nontechnical language. In a few minor or subsidiary details exception might be taken to the author's generalizations. But to dwell on these might perhaps overweight their significance in a book which otherwise is accurate and instructive.

H. L. S.

ELEMENTARY TOPOGRAPHY AND MAP READING

----- by Samuel L. Greitzer

McGraw-Hill Book Co., \$1.60

NEVER before have we been so conscious of the importance of maps, yet, as the author of this book points out, "the



"Natural History"

ILLUSTRATIONS

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COLOR PROCESS, BLACK AND WHITE, BEN DAY, LINE

Above Illustrations: Part of Plains Group, American Museum of Natural History. Photo by T. L. Bierwert and C. H. Coles



training in ability to read maps has been left almost entirely to chance." The few texts available on the subject have been of an advanced nature and intended for the mature student with technical training. The present text is specifically intended for the high-school student (and incidentally his parents and their friends).

The author first gives a brief picture of the history of maps and the problems faced by map-makers. This is followed by an excellent chapter on the "Applications of Mathematics to Map Reading." Many lose sight of the fact that "Although the construction of a map may require mathematical knowledge of a high order, it is quite otherwise as regards the ability to read one." Anyone who has been hesitant about attempting to read modern maps will find the simple mathematical explanations in this chapter the most valuable part of the book.

Brief descriptions are given of the projections most frequently employed. The very brevity of the descriptions, however, proves that "map language" can be simplified and that terms such as "polyconic," "azimuthal," "orthographic," and "homolographic" can become familiar terms to map-readers.

Considerable attention is given to topographic maps, to map reading in the field, and to the new aerial photographic maps. In view of the fact that future development of air transportation will probably make these particular maps of great importance it would seem that more space might well have been devoted to this section.

The diagrams and illustrations throughout the book are well chosen and clear. There is also a short, useful bibliography and an index. This text may have been written for high-school students but it should certainly be added to the library of anyone who wishes to gain a practical knowledge of the language of maps.

IRENE F. CYPHER.

THE FLOOR OF THE OCEAN

by R. A. Daly

University of North Carolina Press, \$2.50

"NEW Light on Old Mysteries" is the subtitle of this book, which comprises lectures given at the University of Virginia in 1941. It is, indeed, filled with light, partly because of the clarity of thought and expression to be expected of Professor Daly, but no less because of the discussion and integration of much technical literature devoted to matters of long-standing controversy such as, for example, the problem of submarine valleys on the continental shelves.

The work is in three parts, entitled "Foundations of the Great Deep," "Submarine Mountains," and "Continental Terraces and Submarine Valleys." Each of these is in turn divided into eight or ten sections, and each except the last ends in satisfactory "conclusions." In the case of submarine valleys, however, the author closes rather with a "summary" in which he formulates rival hypotheses without espousing any.

The book is an admirable source of

the kind of information about the evolution of the physical world that every layman would like to add to his intellectual capital. The composition and relative weight of rock in the earth's crust, under both ocean and continent; the relation of the last Glaciation, including the often overlooked interglacial stages, to sea level and island growth; the elasticity of the crust, its convex and concave bends, and the rate of terrestrial "rebound" in areas from which a vast recent mass of ice has melted—such are some of the subjects well handled in both text and illustration.

Professor Daly's writing is simple, direct, and inductive. Here and there, when circumstances warrant, it blossoms into vivid language, as in the account, on pages 48-49, of the approach to a remote oceanic island, and the queries aroused in a geologically-minded traveler.

R. C. M.

DAVID DALE OWEN

Indiana Historical Collections XXVII
by Walter Brookfield Hendrickson

Published by the Indiana Historical Bureau

"GEOLOGY stands not still; she knows no rest; she recognizes no stability. What has been, has vanished,—what is, is evanescent,—what is to come will endure but for a season." Thus did Geology find voice a century ago in David Dale Owen, pioneer geologist of the Middle-West.

W. B. Hendrickson's concise but colorful biography follows the life of this Scotch-born scientist from "University" Europe to "Frontier" New Harmony, Indiana, and beyond into the "Prairie-wilderness."

Owen began his career officially in 1837 as head of Indiana's first geological survey. He established the State's geologic relationship with her neighbors, applying English nomenclature wherever possible to formations and discouraging local designations.

In 1839, with one hundred men, he conducted a geological "blitz" for the United States Land Office, covering the 11,000 square-mile lead-bearing "corners" of Illinois, Iowa, and Wisconsin in two months flat.

Owen's crowning achievement was his mineralogic exploration of the Chippewa Land District south of Lake Superior for the Federal Government in 1847. The published results, containing the first broad structural study of the Upper Mississippi Valley, secured his international reputation as America's foremost authority on Midwestern geology. This survey was extended into Canada as far as Lake Winnipeg and into the Upper Missouri country of Iowa to the south. Co-worker, John Evans, penetrated westward to the South Dakota Badlands, where he secured a collection of fossil mammals, later identified by Joseph Leidy.

With the completion of this project, the Hoosier scientist spent his few remaining years as State Geologist for Kentucky and then Arkansas, engaging busily in field work but accomplishing nothing of note.

Although of little general interest, this

informative little volume will prove valuable to the historian of the Mid-west and to those who carry on in the cause of the Earth Science.

GIL STUCKER.

BELOVED SCIENTIST:

Elihu Thomson, A Guiding Spirit of the Electrical Age

by David O. Woodbury

Whittlesey House, \$3.50

HERE is a fascinating biography of the great inventor, engineer, and philosopher, with a most appropriate title. It was written by the author of the best book about the new 200-inch telescope, who has the ability to discuss technical sciences in a clear, readable language for the layman.

Elihu Thomson, of Scotch extraction, was born in England and when five years old migrated to America with his parents. He graduated from Central High School in Philadelphia and later became teacher of chemistry in that famous school. Henceforth and throughout his long life he was affectionately known as "Professor" Thomson.

This biography is necessarily the history of the electrical industry and its founders. Throughout the book we have intimate glimpses of Edison, Westinghouse, Steinmetz, Kelvin, Crooks, Marconi, and many others as their trails crossed in their pioneer work in harnessing electricity for man's needs.

During a productive period of 60 years, he was granted 692 patents. (This record was exceeded only by Edison, who had a few hundred more.) Professor Thomson made at least a dozen major contributions. Among them were the three-coil dynamo, electric welding, the cream separator, alternating-current distribution, the electric meter, the repulsion motors, the oil-immersed and other types of transformer, the magnetic blowout, basic inventions in trolley car and train control, lightning arresters, and fundamental improvements in X-ray tubes and high-frequency radio apparatus.

For many years he was acting President of Massachusetts Institute of Technology. When his own company merged with the General Electric Company, he formed the first pure research laboratory ever founded within industry. In recognition of his achievements, he was awarded nearly a score of medals and decorations, including all the most significant ones in America and abroad.

CLYDE FISHER.

JOURNEY INTO THE FOG

by Cornelia Goodhue

Doubleday, Doran and Company, Inc., \$2.50

TRUE stories of human daring and endurance on land and sea come so fast these days that even a Rickenbacker tale can hold only momentary attention. It seems regrettable therefore that this fictionalized narrative of what is probably the world's most ambitious and most costly

exploring expedition should be published at this time. However, this twenty-five-year adventure, although now two hundred years old, is easily assured of permanent interest for American readers, both young and old.

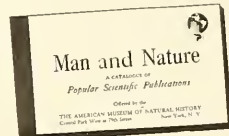
What we have is an abbreviated account of the voyages of Captain Vitus Bering, undertaken at the command of Peter the Great, in part to determine the geographic relations of Asia and America. Thus between the years 1725 and 1741 this seasoned naval officer—a Dane by birth—supervised two arduous overland journeys from St. Petersburg through the wilds of Siberia to the Pacific shore of Kamchatka. This feat involved the transport of a thousand men, provisions, and equipment over distances of from 3500 to 5000 miles and required a period of from three to four years. Once there, the Commander built the several ships with which he first charted the Asiatic shores north through the strait that bears his name and later sailed east to our North Pacific coast and back along the Aleutian Islands, finally to be wrecked and, with nearly half of his crew, to suffer death from scurvy on one of the Commander Islands, only a short distance from his starting point. The tragedy is traceable to a number of causes, remote and immediate, the most obvious of which was the ever-present fog.

Our author, perhaps rightly, makes the brilliant naturalist, G. W. Steller—another foreigner—the chief villain of the story. But, guilty or not, he has long had his reward. Incidentally, Steller preceded V. Stefansson in maintaining health largely

on a meat diet. Unfortunately without warning, the old style documentary dates have been shifted forward eleven days to conform with our present calendar. Also, the end-piece map might well have shown the principal routes traveled.

N. C. NELSON.

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SIRS:

. . . I get *NATURAL HISTORY* here in Scotland more regularly now than formerly, although delayed, and as usual I enjoy it very much. A splendid job is being done to maintain the contents and get-up of the journal, and once this beastly struggle is got out of the way, still better matter may be confidently expected. The Museum is performing a magnificent piece of educational work.

WILLIAM ROSS.

Kirkcaldy, Fife,
Scotland.

* * *

SIRS:

I have been an enthusiastic subscriber to your magazine for almost two years and my only regret is that I did not discover your wonderful publication sooner.

I was most interested in the article on seismology, published in one of last year's issues of *NATURAL HISTORY*. I am secretary to a geophysicist and avidly read all literature concerning any branches of the fascinating science, geophysics.

I think the most commendable feature of your Magazine is that scientific data of varied types are brought to your readers in language easily comprehended by people such as myself,—namely students who have only their interest to aid them in their studies.

The cover photographs on *NATURAL HISTORY* are certainly works of art. . . .

Thank you for the many hours of profitable and enjoyable reading you have provided in your excellent publication.

JANET S. HARGREAVES.

Pelham, N. Y.

* * *

SIRS:

Again kindly allow me to compliment you on maintaining the high standard of the magazine during these unsettled times. I sense and very likely you know how difficult it is to secure interesting articles with the entire world at war.

I would like to make the following suggestion, which I believe would be of continued interest with your readers. Would it not be possible to include in each issue a department to describe the practical, simple carvings of jade, meerschaum, and amber, or the cutting of semi-precious stones?

I believe such a department . . . would provide many readers with the means of a part-time hobby and would also provide useful information. . . . I also miss the articles on photography written by Mr. Coles.

PHILIP C. HOLDEN.

Newton Center, Mass.

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SIRS:

The sunflower seeds in these two photographs were put in the sun with an idea of drying them out. But before I could collect something on which to spread them, this chipmunk arrived.

He worked steadily from about 1:00

P.M. till around 4:00 loading up, scalloping off to his hiding place under the front piazza, and returning, empty-jawed, with absolutely no time out to rest.

He was one happy chipmunk—though tired—at sundown! HELEN B. HAMILL.
Worcester, Mass.



SIRS:

I have asked at newsstands many times for a magazine like yours, never knowing there was one published. Now I have my first edition, this February. I love it! . . .

I cannot thank you enough for introducing yourself.

JEANE BAYLISS.

New Dorp, Staten Island, N. Y.

* * *

SIRS:

In January at a meeting of the Hudson Fish and Game Club, I made a motion that we subscribe to your magazine for the Hendrick Hudson Chapter Free Library of the D.A.R. My motion was enthusiastically received and passed with a unanimous vote.

I took to the meeting one of your editions, which was much admired. After the meeting the president of our club said to me that he was glad I had brought this matter up and that a wiser selection of publication could not have been made. He was in a position to judge, having read the magazine for some time. I know that where it is going it will be much appreciated and be helpful to the public. After the members of the family and I

have read my own copy, I send it to the wife of an officer at Fort Benning, Georgia, where it brings cheer to many persons at the Camp.

I hope you will publish this among your letters, as I am sure it will be the means of getting other organizations to subscribe to your most educational and attractive publication for their local free libraries.

CHARLES E. FABER.

Hudson, N. Y.

* * *

SIRS:

. . . I was certainly glad to read that copies of your beautiful covers can be obtained. I've enjoyed your magazine for so many years and am constantly amazed at how it manages to keep such high standards at all times. . . .

BARBARA ELLEN ROGERS.

Madison, Wisconsin.

* * *

From a world traveler and writer:

" . . . I get about 50 magazines a month, and *NATURAL HISTORY* is the only one I really read from cover to cover—and then want more."



THE COVER THIS MONTH



People of the Earth • Insects • Cities of the Moon

Nature • Feeding • Buffalo • Goats • Great Blue Heron

The Wood Duck is our most beautiful duck. Although it was once a common summer resident of the region around New York City and New England, by 1910 it was on the verge of extinction as a result of overshooting. Since it was taken off the hunting list, its numbers have shown a decided increase, and the bird may be seen frequently in fresh-water ponds, forest-bordered streams, and flooded woodlands.

It builds its down-lined nest in a hollow tree, stump, or bird box, and has even been known to nest upon the ground. The number of eggs varies from 8 to 15, and the color is pale buff to creamy white.

The Wood Duck breeds locally throughout the United States and Canada. In late August or September the ducks begin their

migration southward, and a winter Wood Duck is a rarity in this region. They return to the north when the ice has left the ponds and streams, and continue to pass during late March, April, and even into May.

This specimen was photographed in Kodachrome by Charles H. Coles at the American Museum of Natural History. It is part of an exhibit showing the birds which may be found within a 50-mile radius of New York City. The male of the species, shown on the cover, has a long crest of metallic green, blue, and purple, relieved by white markings on the head and throat; the female is largely brownish. In flight overhead these ducks show a white or whitish belly. The scientific name is *Aix sponsa* (Linnaeus).

ON YOUR RADIO

Program of the American Museum of Natural History for April, 1944.

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from 3:30 to 3:45 P.M.

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- April 5—*Nature Hobbies*—
MISS LUCY CLAUSEN, MR. EDWIN WAY TEALE
- April 12—*American Heritage*—
DR. IRENE CYPHER, DR. HENRY E. HEIN
- April 19—*Natural Weather Signs*—
MISS LUCY CLAUSEN, MISS MARIAN LOCKWOOD
- April 26—*Good Neighbors—New World Style*—
DR. IRENE CYPHER, MISS FRANCES GRANT

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LITTLE *Didelphis*

By L. ROBINSON GLEASON

RUMOR had it that opossums were fairly common in our neighborhood, but it was a red-letter day when Little Didelphis came to the cabin clearing in broad daylight. Little Didelphis was hungry.

Winters of much snow are apt to bring unusual visitors to the bird feeding station, and the winter of 1942-43 was heavy with snow. The first week of December found the oak woods buried under a thick, wind-packed white blanket. Animals moved about with difficulty or stayed under cover. Only the birds came out freely.

Toward noon, one day, as I glanced casually from the cabin window at the tree suet station, I "came alive" very suddenly, for a strange, small whitish creature was spread-eagled on the suet basket, trying desperately to get a bite to eat. A queer, bare tail advertised an opossum, a very hungry opossum. He should have some suet of his own, so I started for the food box. By the time I was outdoors he had climbed up to the small shelf cover of the suet holder. He seemed tired and, indifferent to the world in general, he was huddled down in a fluffy hump where the weak sunshine was brightest, letting his tail curve under the edge of the shelf.

Most of the wild folk hereabout know that this is a safety zone, but they are shy, nonetheless, and do not like to have human beings dashing around. An opossum was a new experience for me and therefore to be treated with due caution. Quiet and slow as my approach was, he was evidently aware of me when I was some 20 feet away. Not that he moved or made any change in position, but there was an alertness to his pricked-up ears, and his bright eyes were focused sharply upon me. He was so young that it is probable I was as much of a new experience to him as he was to me. He was Watchful Waiting personified as I went nearer, stopping frequently, talking to him in a low tone, holding out a small piece of suet at arm's length. He still huddled in frozen silence when the suet was held close to his little sharp nose and then placed under it on the shelf. He saw only me, and then the tip of his nose began to twitch a little. It was a pink tip, a warm beautiful shade of pink, red-pink, like nothing I had ever seen on man, beast, or flower, a little flat pink two-hole button at the end of a long, white nose. And then he opened his mouth, wider and wider, until saliva dripped from it. He made no sound nor other movement, and the menace of his threatened bite was entirely spoiled by the baby-pink lining of his mouth. His little teeth were sharp and white like a kitten's. His two forefeet peeped out from beneath his furry body. The toes were pink to match his nose and his slim legs were a black-brown as if he wore long mitts like an old-fashioned lady.



While I returned to the cabin window he dozed off in the warmth of sunshine. Presently he stirred, grasped the suet firmly in his forepaws and nibbled at one end. A downy woodpecker hitched up the tree toward the suet basket but the opossum paid no attention, going on with his eating, changing his position a bit as he gnawed on the frozen suet. He was still busy with vigorous effort when I looked down for a moment at the notes I was scribbling, and then—he was gone, no opossum, only empty shelf and bare tree trunk remained. Puzzled at such speed in vanishing, I examined the surroundings, and there at the foot of the tree Little Didelphis was picking himself up. He had backed off the shelf and fallen about four feet into a pile of snow. His one concern at once became the morsel of suet, for which he nosed around, burying his face in the snow until he found it. Then he sat in the snow and continued his lunch. A few minutes later he ambled toward the cabin and disappeared. His trail,

marked by dragging his tail in the smooth snow, led to an opening under the front porch.

In the late afternoon he was again on the suet station. My bold advance this time caused no more reaction in Little Didelphis than the earlier cautious one had, and again a piece of suet was offered, placed, ignored. He looked so irresistibly soft that I dared to stroke the back of his head very gently with one bare finger. His fur was as soft as down, and I was thrilled by the feel of it. But he wasn't. He laid back his black ears like an angry horse and, with open mouth, drooled copiously, screwing his tongue around in wrath.

I did not see him go nor did he leave any tell-tale tracks. I hoped he was one of the "seven sleepers" in this Michigan climate and would hole up near-by for the remainder of the winter, but he may have gone far-off in a huff over the indignity he had suffered. At least I have not seen any of the opossum family since then.



May

NATURAL HISTORY

1944

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Vegetable Oils • Inland Shore Birds • Cliff Cities

VOLUME LIII. No. 5

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NATURAL HISTORY Magazine



Beyond Knowledge

KNOWLEDGE has many boundaries. It is bounded by ignorance and by that which cannot be known in the realm of metaphysics, by the categories in which we think and by the axioms from which we reason. But the boundary which particularly concerns us is the boundary between the known and the unknown but knowable,—that which cannot yet be predicted from our imperfect understanding of past experience but which will still be experienced in our lives and our actions.

Knowledge is gained by analysis but can be used only in synthesis. Analysis alone can never produce a plan to guide our steps. The act of planning is in itself an act of synthesization of knowledge. And in the execution of our plans we unavoidably bring about the further integration of the effects of all the factors which are known to us with the effects of those of which we are still unaware. In applying his knowledge of pure substances the chemist will experience also the effects of impurities he did not know about. They may be negligible or upsetting and thereby lead to new research. When dealing with the recognized enemies of our environment we upset the equilibrium of nature in ways we are rarely able to foresee and generally have to deal with afterward.

Every human action is therefore a venture beyond knowledge into a complete synthesis of the known with the unknown, with all the risks which such a venture entails. These are risks which must be daily borne by all mankind, by the humblest followers as well as by their chosen planners and leaders.

When this is true, has science the right to stand apart and wash its highly trained hands of the terrible responsibility of synthesis, while confining itself to the production of more facts by analysis? And is

the public wise in maintaining an attitude which makes it almost impossible for the scientists to deal openly with such uncertainties as we are all facing in our daily lives, as individuals and as members of a nation?

The tradition of empiricism was born of a positive faith in knowledge based upon observations and experiments. It has degenerated into a negative denial of the value of reasoning beyond the known facts. Among the adherents of this diminishing concept of the functions of science, attempts at synthesis find little encouragement and are often met with open scorn, except within the narrow confines of the axiomatic method practiced by the exact sciences and applicable only under "ideal" conditions such as we never meet with in life.

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A. E. Barr

*Director The American Museum
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NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LIII—No. 5

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MAY, 1944

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----- by William Howells

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THE story of man's emergence from the jungle of organic variation which lies behind him and the somewhat puzzling way in which he himself has given rise to a multiplicity of types, varieties, and breeds embody a perennial source of interest. It is, therefore, a distinct pleasure to come upon a book which not only tells this fascinating story in a manner that is delightful to read but, even more, brings the account up to date. In *Mankind So Far*, Dr. William Howells has gathered all the recent and exciting discoveries relating to human evolution that have not yet found their way out of scientific reports and monographs. He does more, however, than report these new fossils, which in itself would be useful; he brings an original and active mind to the consideration of their meaning, thus adding a flavor that is distinctive and attractive.

It is, I think, a rare quality in a book that allows it to be placed either in the hands of a student or of a casual reader with equal chances that it serve its purpose. *Mankind So Far* is such a book. I heartily recommend it for all classes of readers intelligent enough to want to know about man's evolution. H. L. SHAPIRO.

CLOUDS AND WEATHER PHENOMENA

----- by C. J. P. Cave

Second Edition, Cambridge University
Press, \$1.75

THIS little book, now thoroughly revised, is in its fourth printing. It will continue to be useful chiefly because of its illuminating photographic illustrations and its extremely simple explanations of cloud forms, sky colors, twilight, sunset rays, rainbows, halos, mirages, and related phenomena.

The discussion of all these subjects is elementary and non-mathematical, but is

sufficient to answer many of the questions that continually arise in the minds of laymen. Two pages devoted to aspects of the moon, for example, contain the kind of factual information which, if made part of the education of every child, would fill an appalling hollow in the mental content of most adults the world over.

American and many other non-British readers will need to remember that the meteorological point of view of the author is that of an Englishman to whom west winds bring rain.

R. C. M.

LAKE HURON

----- by Fred Landon

The Bobbs-Merrill Company, \$3.50

SINCE Lake Huron was the first of the Great Lakes to be "discovered," this book is appropriately the first to appear in "The American Lake Series," projected under the editorship of Dr. Milo M. Quaife of the Detroit Library. The author of this book, Doctor Landon, is a trained historian and a veteran journalist. At present he is Librarian and Associate Professor of History in the University of Western Ontario. Not only is he an accomplished historian, but he was in his earlier years a lake sailor and has traversed the waters of Lake Huron scores of times. His familiarity with the moods of these waters and his knowledge of the men and the ships that sail them give him an invaluable background.

The book is a history of Lake Huron and the St. Clair River into which it empties,—a vivid account of some of the happenings around and upon these waters during the years since Champlain first saw Georgian Bay. Champlain called the lake, "The Fresh Water Sea," but his name did not stick. It got its permanent name because it was in the land of the Huron Indians.

In the first part of the book, the author describes the struggles for mastery of the fur trade between the Hurons and the Iroquois, and the final complete victory of the latter. He relates the story of the decline of the French influence, correlated with the disappearance of the Hurons; and the tragic fate of the missionary martyrs to whom we owe so much for the early history of this region and for the unfolding of our knowledge of its geography. In the second part he describes the islands, shores, and rivers. The third part is devoted to four Lake Huron stories, namely, the visit of Anna Jameson; William Beaumont, "Backwood Physiologist;" "Piratical Doings on the River St. Clair;" and the *Pewabic* and the *Asia*. The fourth part of the book is a history of the lake's shipping. In 1942, 92,000,000 gross tons of iron ore alone passed through the lake.

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NATURAL HISTORY, MAY, 1944

The book is an excellent one to start the series on the Great Lakes.

CLYDE FISHER.

MEDICAL PARASITOLOGY AND ZOOLOGY

----- by Ralph Welty Nauss

Paul B. Hoeber, Inc., \$6.00

WHILE this publication is intended primarily as a textbook, it will have a much wider appeal. Anyone interested in learning something about the diseases caused by the parasites that infest man would do well to consult this book. The life cycles of the organisms causing disease are presented in the form of clear and informative diagrams so that the student or lay reader, can visualize the often quite complicated series of developments in the organism concerned. The illustration of the cycle of *Trichinella*, which infests man as a result of eating under-cooked pork and which causes trichinosis, is a typical example. It shows how the disease may be transferred from pig to pig if pork scraps are used in feeding, from pig to rat, and from rat to rat, and from rat to pig.

Malaria and other insect-borne diseases are covered, and there are chapters on biting insects and other arthropods, as well as snakes, fish, and clams. Such features as the preparation of material for study, the use and care of equipment, methods of obtaining and preserving material will be welcomed by all students. One of the most pleasing features is a complete glossary of the terms used, a feature that will be greatly appreciated by every reader.

Doctor Nauss has written this book after many years of experience in the field and in the classroom, and while he deals with the subject from the viewpoint of the medical man, the field of medical entomology is adequately covered and the book will prove of great value to all who have anything to do with parasitology insofar as it affects the human race.

C. H. CURRAN.

INTRODUCTORY ASTRONOMY

----- by J. B. Sidgwick

Philosophical Library, New York, 1944

INTRODUCTORY ASTRONOMY, A Guide for Night Watchers, is a little volume designed to introduce this fascinating subject to such specialized groups as airplane spotters, but that really means that it was planned to lead any beginner into a study of the night sky. The old saying, "It is an ill wind that blows nobody good," applies with particular force in these dim-ol' nights of wartime, for countless inhabitants of our cities have recently become star-conscious,—persons who for many years have not found it possible to see any but the brightest stars. During the brightly lighted nights before the war it was hardly possible for city-dwellers to see the gorgeous Milky Way.

The author takes nothing for granted,

begins at the beginning, and leads his reader step by step into the subject. His chapter entitled "The First Night Out—Finding One's Bearings" explains many things so clearly and yet so briefly and without technicality that it makes a most inviting approach. Then in the short space of eleven pages he deals with the planets, telling his readers what they want to know. Next in a brief chapter he discusses the Moon, its distance, size, surface, relation to eclipses, etc. Then follow short chapters on Asteroids, Comets, Meteors, Stars, Star-clusters, Nebulae, and our Galaxy, giving the essential facts about each. These chapters are surprisingly short,—in all they occupy only about 60 pages, or about half of the little book.

The latter half of the volume is devoted to summarized data concerning the Sun, Moon, and Planets, and to excellent original charts of the Constellations. A most useful feature of these star-maps, and a unique one, is the scale that is marked on each one. This scale represents a six-inch ruler held at arm's length against the sky, which subtends approximately 13 degrees. Why did not someone think of this much needed device before? Altogether the book is simple and clear, practical and dependable.

CLYDE FISHER.

DR. TOMPKINS EXPLORES THE ATOM

----- by George Gamow

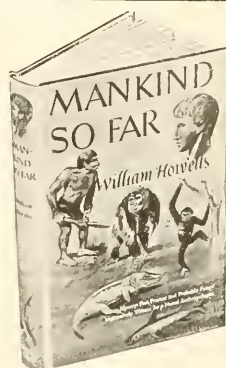
The Macmillan Company, \$2.00

DR. GEORGE GAMOW, Professor of Theoretical Physics at the George Washington University in Washington, D. C., is a creative scientist in the finest sense of the word. His authoritative book on *Structure of Atomic Nuclei and Nuclear Transformations* places him in the forefront of the ranks of modern physicists. Those interested in astronomy are familiar with his books on *The Birth and Death of the Sun* and *The Biography of the Earth*.

Doctor Gamow has also earned the right to be called the Lewis Carroll of modern physics, a not unenviable title. In his two books, *Mr. Tompkins in Wonderland* and *Mr. Tompkins Explores the Atom*, Doctor Gamow has presented to the lay public some of the most difficult problems of modern science in a manner at once lucid and entertaining. Certainly anyone who pops down the rabbit hole with him in his latest book will see wonders no whit less strange than did Alice. The famous encounters with Tweedledum and Tweedledee, and the Queens Red and White, can't hold a candle to the fascinating adventures of Mr. Tompkins inside the atom.

But *Mr. Tompkins Explores the Atom* is not a fairytale. It is a serious, highly

Continued on page 239



A noted anthropologist writes the most exciting story science has to tell...

MANKIND SO FAR

By WILLIAM HOWELLS

Research Associate, American Museum of Natural History

HOW ancient is man?
WHERE did man come from?
WHEN did man first walk upright?
WHY is man's brain so large?
IS Neanderthal man our ancestor?
ARE we descended from existing species of apes?
WILL man become a "super-man"?

ANSWERING THESE and hundreds of other questions about *homo sapiens*, the "animal that wears clothes," William Howells tells the whole story of man's evolution from the era in which fishes were the dominant form of life. Though the story ends with man as he is today, a fascinating final chapter projects his future possible development to 1,000,000 A.D.

Man may represent the high-water mark of evolution, but otherwise he fits readily enough into the great framework of natural history, and that is how he should be judged." Written with wit as well as wisdom and authority, MANKIND SO FAR is a book that belongs on your shelf with *Man's Rough Road* and the works of Earnest A. Hooton.

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COWBOY LEMLEY

Las Cruces • New Mexico • Box 128

To the Chocó in the Schooner "Askoy"



Photograph by Hugo van Kuyck

By ROBERT CUSHMAN MURPHY *

▲ "ASKOY" crossing the Atlantic. Her rig was simplified for the Pacific investigations

A scientific expedition explores one of the least known coasts in the world—a fascinating region lying just south of the Panama Canal

IF you stand atop Ancon Hill, near the Pacific entrance of the Panama Canal, you can look out of the bay and gulf and across a limitless expanse of tropical ocean. This is the "South Sea" of Balboa and his followers, for it appears to lie not west of what the Spanish discoverers called *Tierra Firme* but south of it. At your feet are the clusters of fortified islands, close to the Isthmus. Beyond, toward the southeast, the blue summits of the Pearl Islands seem to float

on air. Still farther off, and in the same direction, are the mountains of the mainland south of Point Garachiné, topped by looming Cerro de Sapo. I have never seen this peak from Ancon Hill, but it may well be visible in the clearest weather. Until the war has been won, none but military personnel will have a new opportunity to find out.

On the right or westerly side of the observer, the view toward the open ocean is bounded by the highlands of

the Azuero Peninsula, which drop to sea level at Cape Mala, western gatepost of the Gulf of Panama. All the rest is water.

However, it is easy to add imagination to eyesight and thus to speed on down the western coast of the continent, not only to southern Darien, to Colombia, to Ecuador, to Peru, to Chile, but even to Cape Horn. Much of this long coast I have seen in intimate detail. It is a curious fact that the stretches nearest the Canal Zone are the least familiar to travelers, to geographers, to everybody. Books and articles and photographs about the seaboard between the port of Guayaquil, in Ecuador, and the channels of the

Strait of Magellan may be said to abound. But hunt for similar information concerning the Chocó, which is the luxuriant district between Panama and the Colombia-Ecuador border, and be amazed by the paucity of your findings!

If you wish to mark the area which, in a geographic sense, we may call the vaguest, the most primeval and remote, draw a line on the map southward from Cape Mala, passing through the lonely island of Malpelo and ending at Point Santa Elena in Ecuador. Between that boundary and the opposite concavity in the continent lies one of the least known areas of ocean and seacoast remaining on earth. The Canal, most famous of waterways, opens into the northern end; countless routes of commerce fan out across its waters; travelers toward Lima course swiftly through it, wearing for two days the whites and summer frocks of the Caribbean until they shift abruptly to woolens demanded by the cool current of the Peruvian coast. But the forested shores of Darien, Colombia, and northwestern Ecuador lie mostly below the horizon of steamships. Of ports, not one voyager in a thousand sees any save Buenaventura, and to the world at large the history and geography of the region are veiled in peculiar obscurity.

What creates a climate?

The characteristics of this evidently forbidding region, into which I hope to tempt my readers, are due to cli-

mate. But for its weather, which is both hot and wet, it would doubtless have been thoroughly explored and settled long ago, and would now support populous communities and be visited regularly by travelers from the world outside.

Climate, as every schoolboy learns, is in part a product of latitude, but it can also be profoundly modified by mountain ranges and by the ocean, most of all when these two earth features happen to lie close together. The Andes are the longest mountains in the world and for nearly all their length they lie within sight of the greatest of oceans. It is not always the same chain of the system that meets the eye of a seafarer, because at certain places the original seaward range dips beneath the Pacific, to appear thereafter only in the form of islands or promontories. Along such stretches, the next range, known as the western cordillera, becomes a coastal range, and lands that were once intermontane valleys are now terraces that slope gently toward the shore. Such is the geographical stage at Lima, Peru, where the agricultural plain of the River Rimac may be said to lie between eastern mountains that are still lofty and western mountains that no longer exist because they are submerged.

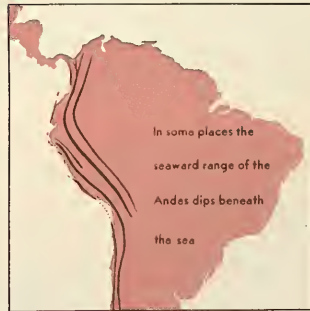
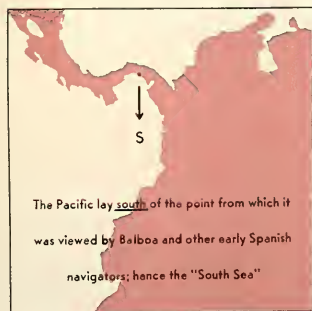
Regardless of which particular range approaches the Pacific or presents its base to the shock of breaking waves, there is a general underlying resemblance in the coastal physiogra-

phy and rock structure all the way from Buenaventura to Cape Horn. The same is true, indeed, along the shore line of southern Panama, where the maritime cordillera is not even part of the Andes but is the younger Sierra de Baudó, the tail end of the Central American backbone.

If we consider landscape rather than geology, however, no corresponding unity exists along the 3,500-mile mountainous water front of the continent. On the contrary, the presence, nature, or absence of vegetation, the different types of weathering and erosion, the diversity in color of soil, combine to make successive scenes very unlike. Two views might be said to resemble each other only to the extent that both are mountainous. That is why the contrasts, rather than the resemblances, are usually emphasized in descriptions of the west coast.

Even in the case of small rocky stacks, jutting from the sea off Colombia and Peru, respectively, a practical identity of size, shape, and composition is likely to be thoroughly concealed except to a penetrating eye. For the Peruvian *farallón* is stark rock between the seaweeds at its base and its guano-whitened summit. The Colombian *vigia* ("sentinel"), on the other hand, is crowned with a mushroom-shaped miniature jungle. The joint planes of its granite blocks are outlined with green vines and epiphytes, and its caverns are overhung with a curtain of withes and foliage.

Larger islands illustrate still better

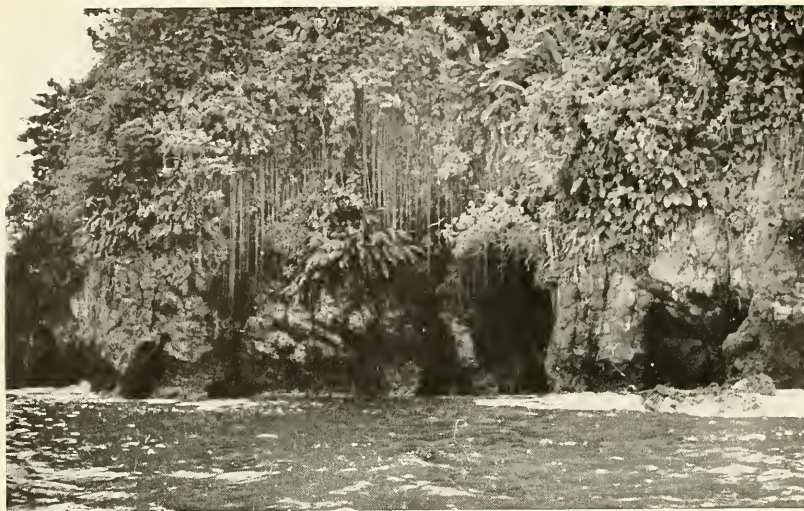


*The author has recently succeeded Dr. Frank M. Chapman as head of the Department of Birds in the American Museum of Natural History. Beginning in 1912, when he represented the Museum on a year's voyage in the whaling brig "Daisy," Doctor Murphy has undertaken most of his field work afloat. He early recognized that

the habits and distribution of oceanic birds can be understood only in relation to the whole cycle of life in the sea, which accounts for his interest in oceanography and marine biology.

The cruise of "Askoj," to be described in a series of articles in NATURAL HISTORY, was the latest of Doctor Murphy's five ex-

peditions in South American waters. Accompanied by Dr. John C. Armstrong, Assistant Curator of Invertebrates, and by other fellow-workers named in his story, he spent four months investigating a region of truly astonishing unfamiliarity—the explanation of which forms part of his theme.—ED.



▲ COLOMBIAN SHORELINE, Cueva Bay. A rich rain-forest vegetation clothes and curtains the rock from roof to water level



► PERUVIAN SHORELINE, Mazorca Island. Here, in the desert zone, we find the opposite extreme—bare rock from sea to crest

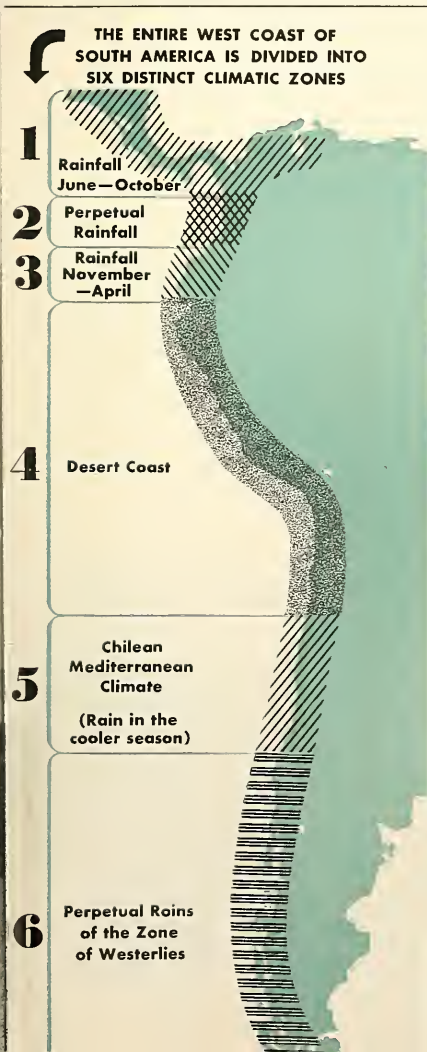


◀ ECUADORIAN SHORELINE, La Plata Island. A climatic and botanical condition exactly intermediate between those of the Chocó and the desert depicted above

▼ ROCKY STACKS likewise show the effect of climate on plant cover. Contrast the luxuriant granitic islet in Colombia below

with the stack at right among the Chincha Islands, Peru. The rock is similar, but one is bare of vegetation





the manner in which environment masks agreement in what might be called the skeleton. Between latitudes 3° N. and 7° S., are three examples of comparable size, all lying on the continental shelf and at similar distances offshore. Moreover, they are evenly spaced along a line approximately 600 geographic miles in length.

The northernmost of this trio is the Colombian island of Gorgona, which I visited in September, 1937, and again in April, 1941. It is drenched with rain from daily showers throughout the year, and smothered under a forest of equatorial luxuriance and of a great wealth of species.

At the southern end of the line is the rainless, utterly barren Peruvian island of Lobos de Tierra, over the parched wastes of which I tramped for a week in January, 1920. One inconspicuous kind of salt-loving plant grows on its sandy beaches, and in a hollow among the blistering rocks there is, or once was, a single stunted algarrobo tree less than waist high. Except for these, the island is as bare and bright as the face of the moon.

Halfway between Gorgona and Lobos de Tierra is the Ecuadorian island of La Plata, memorable to me because of field work in January, 1925, and April, 1941. This island fulfills the diagrammatic requirement of being exactly intermediate between the other two. Each year La Plata receives rainfall during a short season, and about every seven years the precipitation is somewhat more prolonged. The vegetation is largely of a thirst-resisting sort, including fleshy cacti and small trees with thick and polished leaves; but there is also a dense growth of short-lived herbs and trailing vines, which follow the annual rains and produce their seed before the sun-baked mud loses the last of its moisture.

An entertaining note on the environmental conditions at these three islands, as reflected by their respective resources, was recorded by William Dampier in the year 1698. The British buccaneers, he noted, visited Gorgona for water and wood, La Plata for goats' meat and hay to feed their livestock, and Lobos de Tierra for the fresh eggs of sea fowl.

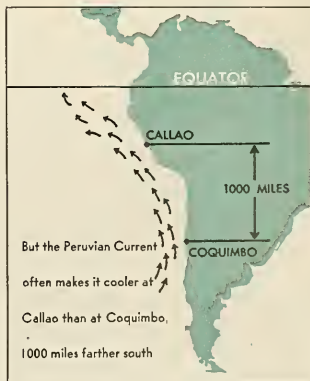
Climatic sequences on the west coast

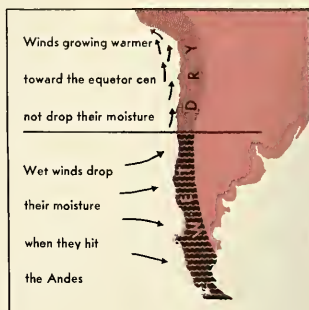
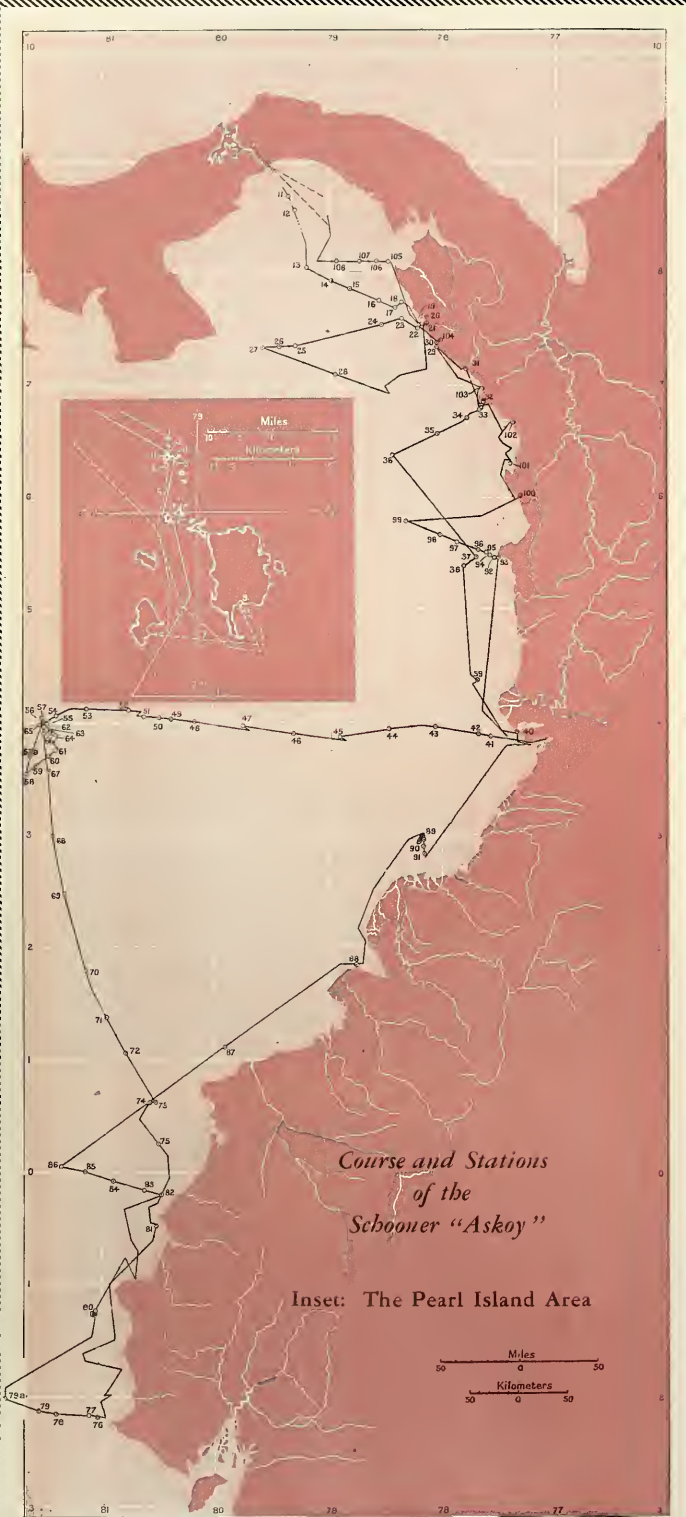
There is thus a remarkably even climatic gradient from Lobos de Tierra to La Plata and from La Plata



to Gorgona, but the same is by no means true along extensive parts of the west coast of South America. A notable example of lack of conformity is that of the desert belt of northern Chile and Peru, where the average temperature does not increase at the normal rate as the equator is neared. On the contrary, the air for long periods is likely to be as cool or cooler at Callao than at Coquimbo, roughly a thousand miles farther south.

These relatively uniform climatic conditions of the desert coast are due to onshore winds blowing over cool ocean water that has reached the surface by upwelling from moderate depths in the Peruvian coastal current. The current has a left-hand trend so that its northward flow is also slightly away from shore, and the upwelling is a compensatory movement to maintain sea level. The arid character of the coast likewise results from the same physical circumstances,





because the prevailing southerly winds become warmed gradually as they advance into the tropics, and the humidity of the air departs farther and farther from the dew point at which condensation and precipitation would be possible.

If we extend our view to regions south and north of the desert zone, we find that there, too, the respective climates are controlled by the same conditions, namely, surface temperatures of the ocean, wind direction, and coastal slope.

In southern Chile, the westerlies that cross temperate waters of the South Pacific are chilled when they rise against the flanks of the Andes, and a cold and heavy precipitation falls all the year on the beech forests.

North of the belt of permanent westerlies is the fruitful Chilean Mediterranean district, where the rainy season of the southern-hemisphere winter (May to August) alternates with the mild, dry, and nearly continuous fair weather of the remainder of the year.

Next toward the north is the desert



zone, which gives way in turn to the savannah country and southern-hemisphere summer rainfall (November to April) of western Ecuador.

Now, if we skip to Panama, we find that the régime is the converse one of northern-summer rains (June to October), which come during the period in which the northeast trade wind belt has drawn back from the tropics. But, in between Panama and Ecuador, lies the Chocó, which may be said to combine the rainy seasons of both its neighbors! The alternating trade winds, or equivalent coastal winds, of the two hemispheres blow over perennially warm ocean surfaces toward the condensing heights of the Andes and Baudó mountains, and rainfall is substantially uninterrupted. The area is the wettest in South America and one of the wettest on earth. Precipitation reaches a peak in October, but in any single month it exceeds the yearly amount of most parts of the United States.

Thus the seasonal rainfall pattern, from north to south along the west coast of South America, falls into the following sequence:

Panama—northern-hemisphere summer.

Colombian Chocó—perpetual.

Ecuador — northern-hemisphere winter.

Peru and northern Chile—rainless.

Mediterranean Chile — northern-hemisphere summer.

Southern Chile—perpetual.

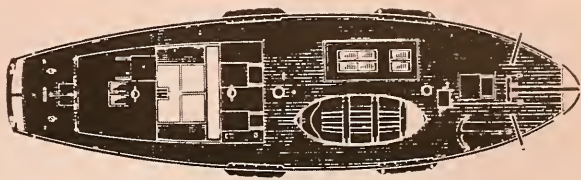
The lure of Chocó waters

It is clear that the ocean lies behind all the diverse types of weather and landscape on the western face of nearly unbroken mountain chains between the Isthmus and the Horn. To one who seeks to comprehend climate, plant and animal life, human culture, or economic geography along the historic west coast, the physical phenomena of the Pacific Ocean adjacent to each section can offer a key.

The oceanic conditions in several of these regions are now well known. For example, the problems of the southern west-wind zone, which are alike all around the globe, are comparatively simple. Those of the coast washed by the Peruvian current have long been clouded by uncertainties and traditional misunderstandings, but studies of the past two decades, especially the investigations of the British research ship, "William Scoresby," published in 1936, have gone far to clarify the scientific picture.



▲ "ASKOY" on the ways at Colón, Panama, preparing for sea duty



▲ THE LITTLE SCHOONER was 56 feet long. It had an 11-foot beam and drew 8 feet of water

▼ COMANDANTE EDUARDO FALLON, of the Colombian Navy, using our range finder



But to the north, between Ecuador and the Gulf of Panama, and stretching offshore from the Colombian coast toward Cocos Island and the Galápagos, is the great bight of warm water that may still be called a virgin field. Here land and sea alike are geographically little explored, despite the fact that the area has known more than four centuries of history influenced by European man.

There are many descriptions of strange phenomena within this region, dating mostly from the times of Spanish conquistadors or British buccaneers but including also a few observations by recent visitors. They are mostly filled with a challenge, because the conditions have never been adequately explained. The constant shoreward set of ocean water along the coast (the opposite of the "divergence" of the Peruvian current); the high temperatures of the upper layer of the ocean in an area just north of the coolest equatorial region of the whole world; the intermingling of surface currents, with resultant foamy border lines and fields of water that dance or "boil" even in calm weather; the profound difference between the quantity of rainfall close to the mainland and in the neighborhood of such an offshore island as Malpelo; the violent circulation in the sea around this island; the nature and relationships of marine life, such as crustaceans, fishes and sea-birds—which make up a fauna with striking differences from that of the Central American coast and almost totally unlike that of waters south of the Gulf of Guayaquil—such are a few of the scientific attractions in the area which, for want of a better name, might be called the "Panama Bight."

Even information intended for mariners is sometimes misleading, as an instance from this region will show. On recent pilot charts of the United States Hydrographic Office, the "Peru Current" is indicated as flowing all around the curve of the Colombian coast and into the very Bay of Panama. Such authority encourages the inhabitants of Panama to attribute the low ocean temperature of their Pacific coast during the heart of the dry season to a penetration into the Gulf of a cool current from the distant south. But, as a matter of fact, the Peruvian current flows westward south of the equator, and never enters the northern hemisphere. The low surface temperatures off Balboa

in January result not from inflowing but rather from *outflowing* waters. They are due to upwelling during the season in which the northeast trade wind blows most briskly across the Isthmus, thus driving the warm surface water out of the Gulf of Panama.

Opportunity knocks

Before 1937 I had already passed four times through the Panama Bight and had also visited Point Santa Elena, La Plata Island, and Buena Ventura. The experiences, however, were scarcely more than glimpses in transit of a fascinating area that had been otherwise missed in all American Museum surveys of the South American coast. My first general reconnaissance came in September, 1937, when I made a nip-and-tuck run from Panama to Guayaquil in Mr. E. Hope Norton's launch, "Wilpet." On this trip the three participants had a rough time of it, but the voyage was nevertheless so profitable from the geographic point of view, and so exciting in its oceanographic and biological hints, that my constant hope was to go back and undertake a thorough job.

Toward the end of 1940, opportunity knocked. Through the generous interest of Mr. Jesse Metcalf, a Fellow of the Museum, I was enabled to charter the 56-foot Diesel schooner, "Askoy." Several other friends then joined in contributing toward other costs of the expedition.¹ The Woods Hole Oceanographic Institution assisted in planning our program and lent valuable equipment that would have been obtainable from no other source. The most important item in this aid was a recently invented instrument called the bathythermograph, of which we were entrusted with two examples. By working a temperature element against a pressure element, the bathythermograph traces on a smoked glass slide a graph which indicates water temperatures at all depths within its range. It is thus the greatest timesaver among sea thermometers, recording continuous temperatures below the surface instead of merely the temperature at a single level.

The United States Coast and Geodetic Survey lent us deep-sea thermometers and apparatus for measuring surface currents. The Hydrographic

Office contributed all our charts, and other departments of the United States Navy gave us hospitable and effective aid in Washington, at Panama, and in the field.

Fully outfitted, we sailed from New York to the Canal Zone in January, 1941, the contingent from home including Dr. John C. Armstrong, Assistant Curator of Invertebrates on the Museum staff, and José G. Correia, of New Bedford, who, since 1912, had frequently served as collector and preparator on American Museum expeditions in several oceans. At Panama our crew was completed by Captain Halford Connolly, of Grand Cayman, as sailing master, Robert François as mate, and Oscar Paar as engineer. Messrs. François and Paar had had the advantage of being associated with our schooner ever since she was launched at Antwerp in 1937. During the greater part of our period at sea we enjoyed also the company of Lieutenant Eduardo Fallon, then commander of the gunboat "Junín" and ranking Colombian naval officer on the Pacific coast of his country. Because of his intimate knowledge of a poorly charted area, his skill as a navigator, and his able share in every branch of the investigations, Lieutenant Fallon's participation was invaluable.

The cruise

Between February 9 and May 26, 1941, we operated "Askoy" between the Gulfs of Panama and Guayaquil, and from the continental coast to a meridian nearly 300 miles west of Point Chirambirá. Our field thus included the shore lines of southern Darien, Colombia and Ecuador, the outlying waters, the oceanic island of Malpelo, as well as the Pearl Islands, Gorgona, La Plata, and smaller islets on the coastal shelf.

February falls within the season when the northeast trade winds cross the Isthmus and whip up the nearly stormless reaches of the eastern equatorial Pacific. From December until April these breezes extend toward the south, ultimately passing the Line. Our rearranged plan, which worked out exactly with the meteorological clockwork, was to cruise into the southern hemisphere before the prevailing winds as far as Point Santa Elena, then to return to Panama between April and June with the recurrent southerly winds that gain ground and momentum as they pursue

¹Mrs. George Blumenthal, Mrs. Edward F. Dwight, Mr. and Mrs. Ward Melville, Messrs. Frederick F. Brewster, Guy Emerson, Edgar J. Marston, E. Hope Norton, Duncan H. Read, Henry D. Sharpe and Carl Tucker.



▲ "ASKOY" approaching anchorage off the southeastern coast of the uninhabited island of San José, Pearl Islands. Canvas is down, and the Mate and Engineer have made ready the anchor



➤ A SHIPMATE not listed in the papers: the parakeet "Little Askoy"

➤ "ASKOY" on station—also on the roll!—while Dr. John C. Armstrong and Engineer Oscar Paar lower a large dredge from the boom



▼ UP from a half hour among the coral gardens. Doctor Armstrong has just had the Dunn diving helmet lifted from his shoulders



the retreating zone of the northeast trades.

During a cruise of approximately four thousand miles, we carried out investigations at 113 precisely fixed stations. Some of these were distributed in series parallel with the shore, others at right angles to it, or across the course of the north-setting coastal current. Six of our transects were continued for distances of from 50 to 270 miles off shore. On the southernmost, westward from Point Santa Elena, we repeated the most northerly line of stations worked by the "William Scoresby" in 1931. To this extent the campaign of "Askoy" was linked up with an earlier survey in the ocean off Chile and Peru.

Routine work at our sea stations related chiefly to the surface layers, down to a depth of about 150 meters. It included meteorological observations, separate water temperatures, vertical temperature sections with the bathythermograph, sea water samples from selected levels, and quantitative catches of the small or microscopic ocean life made with instruments known as plankton-samplers. These, like the bathythermograph, are a recent invention; they record the volume of water that passes through small silk nets, and thus make unnecessary the somewhat dubious calculations formerly based upon net-diameter and the length and speed of hauls. Furthermore, we carried out dredging in many bays and estuaries as well as on parts of the open continental shelf. The Dunn diving helmet was likewise employed in shore waters of mainland and insular localities, particularly at sites of previously unreported coral reefs.

The findings

The spoil of four months at sea includes long columns of figures and a box of smoked glass slides bearing the delicate temperature tracings of the bathythermograph, an instrument which we were the first to use in the Pacific Ocean. Through no virtue or aim of our own, but to our intense gratification, we returned from the expedition just in time for our bathythermograph records to be of practical value to units of the United States Navy operating in the tropical Pacific.

Our treasure comprises also 210 bottles of water samples of varying salt content fished up from numerous levels, several hundred jars containing netted crustaceans, fishes, and microscopic organisms or other plank-



Mr. JOSÉ G. CORREIA, here shown working on a pelican, is a past master in the craft of preparing beautiful study-skins of sea fowl

NOON SIGHT. Doctor Armstrong, Mate Robert François, and Skipper Halford Connolly bring down the sun in one of the numerous daily observations

ton filtered out of measured quantities of water or dredged from the bottom, about five hundred specimens of birds, and miscellaneous natural history collections. The naming and interpretation of many of these still lie ahead, because the war has disrupted our studies by claiming the full services of several of our corps and of specialists among our colleagues.

Nevertheless, reports on the marine fishes and other expedition findings are now in preparation, in press, or already published. The oceanographic data cannot be issued until the United States Government releases them, after victory. There is, however, no restriction against other information obtained in the field, some of which I hope to recount in a manner that may also suggest, at least faintly, the flavor and color of our daily life in the lands and waters of the Chocó.

(To be continued)



hummingbird cycle

By RUTH PETERSON TIFFT



A.M.N.H. photo

One of the smallest mothers among the feathered folk enacts a drama that might have been observed in your own back yard

A WHIRR of tiny wings among the maple leaves, and my interest quickly shifted from the beauty of the June morning to the ruby-throated hummingbird just above my head. It was to be my privilege to witness the whole cycle of the building of the nest and rearing of a family.

In her beak was a wisp of fern wool, which she tucked under her feet as soon as she alighted on a small, straight branch. She gripped the wool snugly as she rubbed her long bill and whole neck over either side of the branch, then over all the wool, apparently spreading some sticky substance.

She picked flakes of gray-green lichens off the trunks of the maple trees. These she used for the shell of her nest. Darting here and there, she brought back lichens, plant-down, the softest of white feathers, and cobwebs to help fasten them all to the branch. She appeared to regurgitate at times, as, like a streak, she ran her shiny tongue out and back as though bringing glue to the tip of it and all over her bill. It looked as though she made deposits of this on the lichens and wool to catch and hold them.

From the beginning she shuffled her feet on the materials that were to line the nest, then pushed and tamped them hard. By so doing she began the cupping and made the impressions that were to hold two eggs, the size of peas, that would be broadly elliptical in shape, and pure white with much the look of fragile pearls.

Standing in the nest as it began to take shape, she raised her wings as she fluffed her feathers and stretched her body. Occasionally she vibrated her wings, rose into the air, then settled herself into the nest again facing in another direction, evidently to shape the whole circle to her body.

It was a lacy jewel of a nest that she finished after four days of concentrated effort. Later I found that I could lay my sewing thimble on its side in the nest and have it touch all around.

From the beginning I had no wish to disturb her, though I was determined to have more of my interest and curiosity satisfied, so I sat at a distance across

the lawn and watched her through Zeiss eight-thirty binoculars.

On each of the two days following the completion of the nest, I believe that an egg was laid. On the second night she slept on the nest, and each night thereafter.

Through the days of sitting she left every few minutes for food: sugar syrup in our feeders or meat in the form of insects which she found in flowers. She was away one to two minutes. On her return she became suspended in the air above her nest and by degrees dropped, much in the manner of an elevator stopping at several floors. Switching her fanned-out tail feathers forward and backward, she suddenly hovered over her nest, then settled down upon it again and fluffed and preened herself into smoothness.

I knew that the babies had been hatched when she perched on the rim and reached her bill down into the nest in two different places. I then gave up watching through binoculars, for I felt that nothing would disturb her now, and took my place on the top of a ten-foot ladder, so that I sat above her and less than an arm's length away. The nest was twelve feet from the ground. I did not realize that it meant a watch of more than two weeks before the babies would fly. It proved to be fascinating mentally, but exhausting physically. Small black flies tormented on muggy days, as well as the minute red bugs. The top of the ladder was too narrow and after a time I felt numb, and my feet and legs persisted in going to sleep. Yet, for all the discomfort, no one could have hired me to stay away.

When I took to sitting on the ladder, careful to make no quick movements, she returned to the nest in a zigzagging manner. Her constant rusty squeak sounded like "Tchk! Tchk!" and she spaced it so that, with the buzzing of her wings, it reminded me of a clicking tap-dancer. It was evident that she did not like my proximity; yet she tolerated me, and more so as the days passed.

I soon learned that she had not chosen this site at random. Only rarely did a thin sliver of sunshine succeed in caressing her pert little tail feathers and thus make them as iridescent as lilac and old-gold changeable silk. When the days were hot from a relentless sun she sat in cool green shade, sometimes matching the yellow-green maple leaves, save that they lacked her iridescence. Directly over her hung three small clusters of several leaves each, growing in such a way that they gave shade and even protection from wind and rain. When I had to sit in raincoat, rubber hat, and boots, everything was drenched except three inches of that maple branch, half of which space was taken up by the exquisite cup of a nest. This remained at all times perfectly dry. Now and then she sat on her favorite bare twig and let the raindrops bathe her, and then she shook and preened herself. On a stifling day she would dart to quench her thirst at a bubbling bird-fountain, dipping her beak ever so daintily through the fine spray from the running water.

The lichen exterior of the nest came straight up and then curled in, making a strong rim that met the soft tan lining. One side was slightly the higher. At dark, when she had settled down for the night, I noticed that she faced the higher rim.

The first baby was born June 19th, the second a day or two later. Hummingbirds regurgitate food to feed their young. To watch her feeding the babies from close at hand, it seemed like cruel treatment for her to reach her needle-like bill way down into their crops and pump food into them. The action actually jerked their heads up and down. Then she stopped, raised her head fairly high and drew more food up into her throat. As she did this there was a movement in her chest and throat. Sometimes I saw the shiny liquid pass down her parted bill into the baby's throat, and when it fed too fast I saw her suck it back.

They were born with the queerest beaks: very short and flat. Despite a slight point, they looked stunted. Until it was feathered the underthroat was coppery in some lights, while in others it was rose. Their mouths were all out of proportion to their heads, and were peach in color.

At first the babies were merely two dark drops spread out in the bottom of the nest. Both together would not have filled a teaspoon. Their growth reminded me of a bowl of bread set to rise, for after days they gradually filled and overflowed the nest.

When the mother fed them, I saw two tiny heads and a bit of gray fuzz. After four minutes she left them for the syrup cup and a run to the garden.

Upon her return she did not always feed them. When she settled on the nest, she made several turns until she had gone half around the circle.

When they were only a day old they lifted their heads for feeding.

When two days old each raised a wing and stretched it high for exercise.

When three days old, on the 22nd, a clear watery fluid spurted from the nest. Both now and then swayed back and forth until they worked their rumps up to the curled-in lichen rim, then sidled a fraction higher and spurted out over the side. Thus the nest was always clean.

On the 25th they raised their heads without any trembling weakness. By night I was astounded at how much their beaks had grown during the day. They were no longer wide and flat, but rather definitely needle-like, $\frac{1}{4}$ inch long.

At the end of the first week—June 26th—they were $\frac{1}{2}$ inch down below the rim. Together they filled the whole bottom of the nest, and one could not have put a flower petal between them. They stirred a little when they heard the hum of their mother's wings. One of them began to lay its bill up against the side of the nest.

They still looked immature on the 27th, much like coarse-haired gray caterpillars. Their little bodies vibrated from the throbbing of their heart beats. They slept almost constantly and did not tumble around as robins and wrens do. They lay quietly, and after a long time one or the other stirred, raised a wing straight up, and then turned itself end for end. As they moved and breathed deeply, the nest breathed with them, as though it had been made of elastic.

The number of food injections varied from one to seven, according to how long they kept their mouths open. This day one began snapping its jaws in eagerness.

When they had settled for the night, the mother perched on the rim. Neither baby raised its head. Again and again she nosed her beak all around them and talked quietly—no mouselike squeak this time, but a faint talking. Still they lay sleeping, so she plopped herself over them. They made no attempt to draw their heads down under. Their two bills ran up the front of her breast, and she was somewhat ruffled as to feathers. She looked dear, but uncomfortable.

On the 29th they were still below the rim but filling the nest fast. They were gray, tan, and brown in color. Their feathers were stubby, and they still had the caterpillar appearance. The weather was delightful. They were feathered, so she left them for long pe-

riods of time, giving them big feedings when she came.

She sat more often on the leafless twig. Upon alighting she always shook and fluffed her tail feathers into perfect order. Here she sat, giving stiff jerky movements of her head, first one way and then the other.

Today the first was ten days old, and still they lay and slept; no clamoring, no noisiness, just slowly raising, day by day, the even level in the nest.

On July first their bills, still nowhere near so long and slender as they were to be, looked much like thick, black rose thorns.

On the 2nd there was another marked increase in the length of their bills, though the bases were still thick.

Now their bodies looked like shabby pieces of raccoon fur. Their tail feathers had become edged with white.

One kept his eyes open for the first time, and he blinked them a lot; yet even when they were closed they had a look of being open. The upper lids close down just as ours do.

Sometimes the mother came soundlessly, but whether or not her wings hummed, the young paid no heed until she actually alighted on the rim. Then up would come two heads, mouths open.

Their coppery throats were on July 3rd a pale gray like their mother's, and both looked sleeker.

With more substantial and less frequent feedings, the mother began to show the effect of less exercise. She became fat, and it seemed as though some of it was a puffed-up feeling of pride and importance. She was very attractive.

Now when the babies heard her wings and she did not come to them at once, they began calling for her. Still, she did not always come promptly. Instead she tried to stir the lice torturing her, by running her beak over her breast; then she lifted her foot and used it vigorously to scratch the back and sides of her head. She dug into the middle back and sides by crossing her wings over her back to the opposite side.

The previous day had been rainy. Today she often perched on the edges of knot-holes in the maple tree, where once had been limbs an inch or so in diameter. I thought she was drinking rainwater with possibly the flavor of maple syrup, but later I found the holes merely damp. I believe she found insects. They must have been delicious, for she frequently ran her forked tongue out in ecstasy.

There was a great difference between the bills of the two babies: one remained thick and thorny, while the other was more needled.

That night the mother could not sleep on the nest, for the head of one of them was too high, and the next night both heads were.

On July 4th, instead of lying facing opposite directions, they faced the same way.

Their back feathers, even in the dullness of an early foggy light, showed much green like their mother's.

The first baby was more aware. Hearing its mother's wings, it raised its head, turned to watch her flight. It ran its tongue out eagerly. When she did not come at once, it yawned. Mother and children did this often on hot days, just as a person would.

The first baby held its head perfectly still while the mother ran her bill up and down its crown, circled its eye with such swiftness that I almost expected the right eye to be missing. She looked over at me, and I thought she was caressing it. Again her bill was thrust back and forth over the crown, and I knew there was an itch that wanted scratching. After she had gone it ran its beak up and down its breast. In another moment the baby raised itself, faced away from me, high enough in the nest so that it could vibrate its wings and strengthen them for flying. It was done rapidly, so that they made a blur and hummed noisily.

By the 5th the nest was decidedly lopsided.

For the first time I leaned over and stroked their heads and backs. They crouched, and the elder one gave a little squeal and opened its mouth wide. Both seemed to relax at once and appeared to like it.

Yesterday one of the babies became peppy directly after a feeding; today both became decidedly so. Off and on both vibrated their wings, though the first did it oftener.

Now they looked like their mother and had the same curiosity, craning their necks to see everything, even stretching out and looking down at the slightest movement of my hands.

The mother was slimmer today, giving more frequent meals for quick strength.

Once she circled above them, went away, and upon her return the first baby actually whistled; then they began yipping, wheedling her to come.

Later, when I patted their heads again, both whined with the same plaintive tone as does a dog when he is outside a closed door and begging to come in. At once they quieted.

Their necks were now speckled a little.

They took to squeaking when they heard their mother, or when they practiced flying, or even without reason.

They shifted sides, and tore the nest lining.

On the 6th I began sitting by the nest at 7:30,

determined not to miss the departure. Robins flutter from the nest to the ground and are not taught to fly as the old fairy-tales told us; but humming-birds practice, and so I expected them to fly right out of the nest. I got a surprise.

At 8:00 the mother did a thing that aroused my curiosity for several days. Standing on the rim she ran her beak cleanly around the outside of the nest, keeping her long bill parallel all the way. During the day she did this three times, and I could but wonder why so much care to restore a nest from which the first baby was due to fly any moment. After this treatment the nest was less loose and lacy, and seemed as good as new again. Perhaps she feared that the babies had stretched it so much that it might break open before they were finished with it. It looked as though she were gluing it, but it would be hard to say. She also brought more plant-down and tucked it deep into the nest.

The babies began lashing their tongues like whips. Occasionally they appeared to be kissing each other as they rubbed their crossed bills up and down together.

The second did today all of the things which the first had done yesterday. The latter was strong enough to lift its foot several times and scratch its own head and neck. It also scratched the head and eye of the second just as the mother had done yesterday.

It was a blustery day, but the babies vibrated despite it, and once they did it together in their sewing-thimble of space. In the morning the first one vibrated as often as three times in five minutes; the younger followed this example in the afternoon. Once a gust of wind nearly blew the first baby out of the nest as it rose to practice. Excitement caused it to shout, "Yip! Yip!" They stood often, so high that the rim of the nest became a girdle; when they rested, they pushed down in until only their faces and bills showed.

Their heads and breasts were freckled today, and they had a white spot back of each eye and considerable white on their underbodies.

Every sound or movement, even in the distance, engendered their curiosity.

Occasionally one or other declined food by keeping its mouth tightly closed as the mother ran her bill up and down.

At last the first baby got up on top of the other's back, so that it was all above the rim, and vibrated five times. This was at ten o'clock. Thereafter it rested, though both continued to stretch a great deal and to spread their wings wide. I wondered if the fitful, rough wind would keep them in the nest; but

exactly at three, the first raised itself, slid out the lower side of the nest, and stood on the branch. Just as simple as that! I held my breath; but something over on the lawn frightened it, and it suddenly flew to a branch six feet away. The mother went to it at once.

Every blast of the wind caused it to cling to the branch, while it vibrated its wings to hold its balance. Beside its mother there was a marked difference in size and sleekness. The baby looked rough in the soft fluffiness of its new feathers. It was given a feeding by the mother running every bit of her bill down into its mouth and throat, though they finished with their bills being locked, and gradually they let go. Soon the fledgling flew a foot away to a bare spot, feet clinging hard, wings spinning, hanging on for its life. Then the wind swept it off! Down, down it dropped to a limb too big for its feet, but it was a place in which to catch a lost breath. Then the blustery wind stopped again. The baby took advantage and flew deeper into the maple tree, in among many leaves that could take the buffeting for it in case the wind blew again. Here it rested for a long time, and the mother came often and fed it.

I reached forward and took the second baby from the nest. It whined, and its feet tore some of the lining. It weighed less than a penny. It was a precious mite to hold, but it had work to do so I put it back.

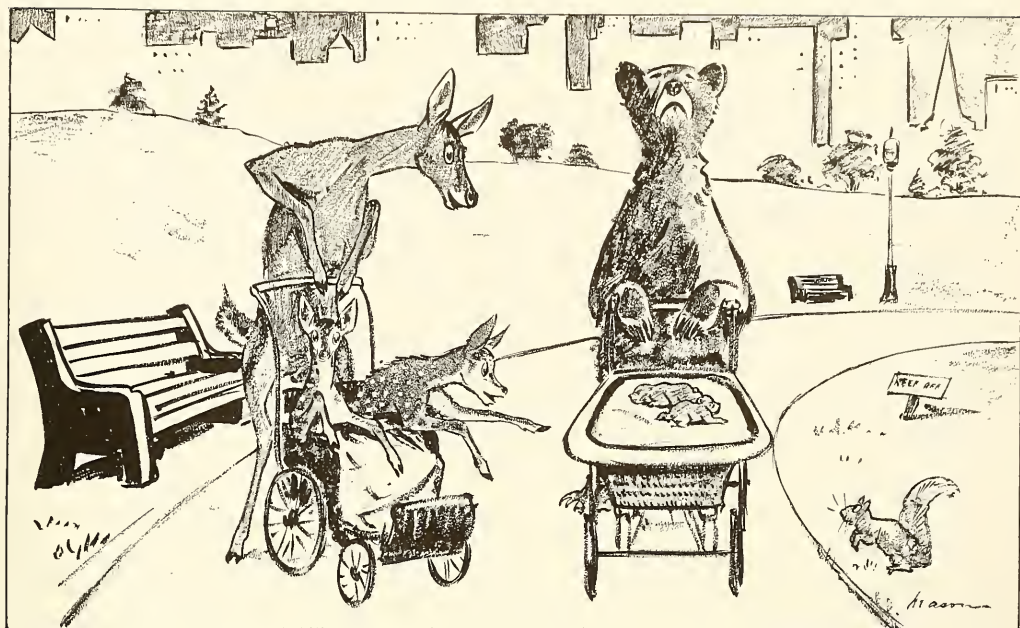
The remainder of that day and all the next, this baby practiced in earnest. I did not see its departure, for the second morning the nest was empty.

It was not difficult to locate the first-flown baby during his first day out in the world. It often called, "Peep! Peep!" sharply and loudly. There it would be on a bare twig, looking like a misplaced pussy-willow, cunning as could be. It took only short flights and long rests. But in just a few days it swooped with beautiful, silent grace down to a lawn syrup-feeder. It returned to its look-out, then darted like a mad streak at a robin that shouted: "Ach! Ach! and sped off on startled wings.

On the 13th, five days after the nest was empty, I came upon the mother hummingbird sitting on a new batch of eggs! Once more the nest fitted her snugly and was beautiful and trim.

When she was finally through with it, I wanted to cut off the branch and the nest with it; but I resisted the temptation, remembering how sheltered and dry it had been at all times. It was a perfect place for a nest next year. After all, it was only fair that I should attempt to repay her courtesy to me all those weeks when she permitted me to snoop into her personal life. So, I left it as an invitation.

Animal Babies



By JOHN ERIC HILL
Drawing by
G. FREDERICK MASON

EVEN in the extreme climates of northern United States and Canada, many mammals have their young before the weather becomes warm, but in general, spring is the season of birth.

Mammal babies are born at various stages of development and take different lengths of time to grow up. The newborn opossum is a tiny, grublike creature, pink and hairless. It weighs only a hundredth part of an ounce and looks hardly more developed than an embryo of other mammals. More young are born than the mother opossum can accommodate, but it is common to find ten or twelve babies in her pouch. Here they stay for several months, growing to look like their parents. When about three months old and the size of rats, young opossums learn to take care of themselves.

A baby bear, when first born, is about the size of a gray squirrel. It weighs only about half a pound, although its mother may weigh 200 pounds. Twins are the rule among bears, although three or four cubs are not unknown. Baby bears are born in the winter, in January or February,

while the mother bear is in winter retirement. They are blind, naked, and helpless. All through the summer and fall the cubs stay with their mother, who takes good care of them, driving away possible enemies and cuffing the youngsters when they do not behave. When winter comes again mother and

cubs den up together. Young bears set out to live their own lives when about a year and a half old.

Meadow mice are famous for the number of descendants a pair may have in a year. Six or eight young are born at a time and under good conditions a new litter may be expected every three weeks. Females have their first batch of babies when about six weeks old, which is a record. The babies are hardly more developed than bear cubs at birth, but they are relatively large, weighing about one-fifteenth of an ounce—the mother mouse weighs an ounce or a little more. The young mice are weaned and begin to make their own living before the next litter arrives.

Young deer or fawns, in contrast to the helpless babies of most mammals, are covered with hair and have their eyes open at birth. While they can walk and move around, fawns are weak and spend their first few weeks hiding in thickets. Twins are usual in our white-tailed deer. Their mother leaves them in separate places, returning to nurse them several times a day. Fawns are weaned when about four months old, the age when they lose their spots, but they continue to stay with the mother deer through the first winter, often longer.

ON YOUR RADIO

Program of the American Museum of Natural History for May, 1944

WEDNESDAYS over WNYC and WNYC-FM

from 3:30 to 3:45 P.M.

Science for the Seven Million

May 3—*Animal Illustrations*—
MISS LUCY CLAUSEN, MISS
HELENE CARTER

May 10—*Animal Empire Builders*—
DR. IRENE CYPHER, MISS URSULA
MORAN

May 17—*Animal Trails*—
MISS LUCY CLAUSEN, DR. T. C.
SCHNEIRLA

May 24—*Around the World with Food*—
DR. IRENE CYPHER, MISS MATILDA
MCKEON

May 31—*Zoo Bears*—
MISS LUCY CLAUSEN, MR. DONALD
MARCY

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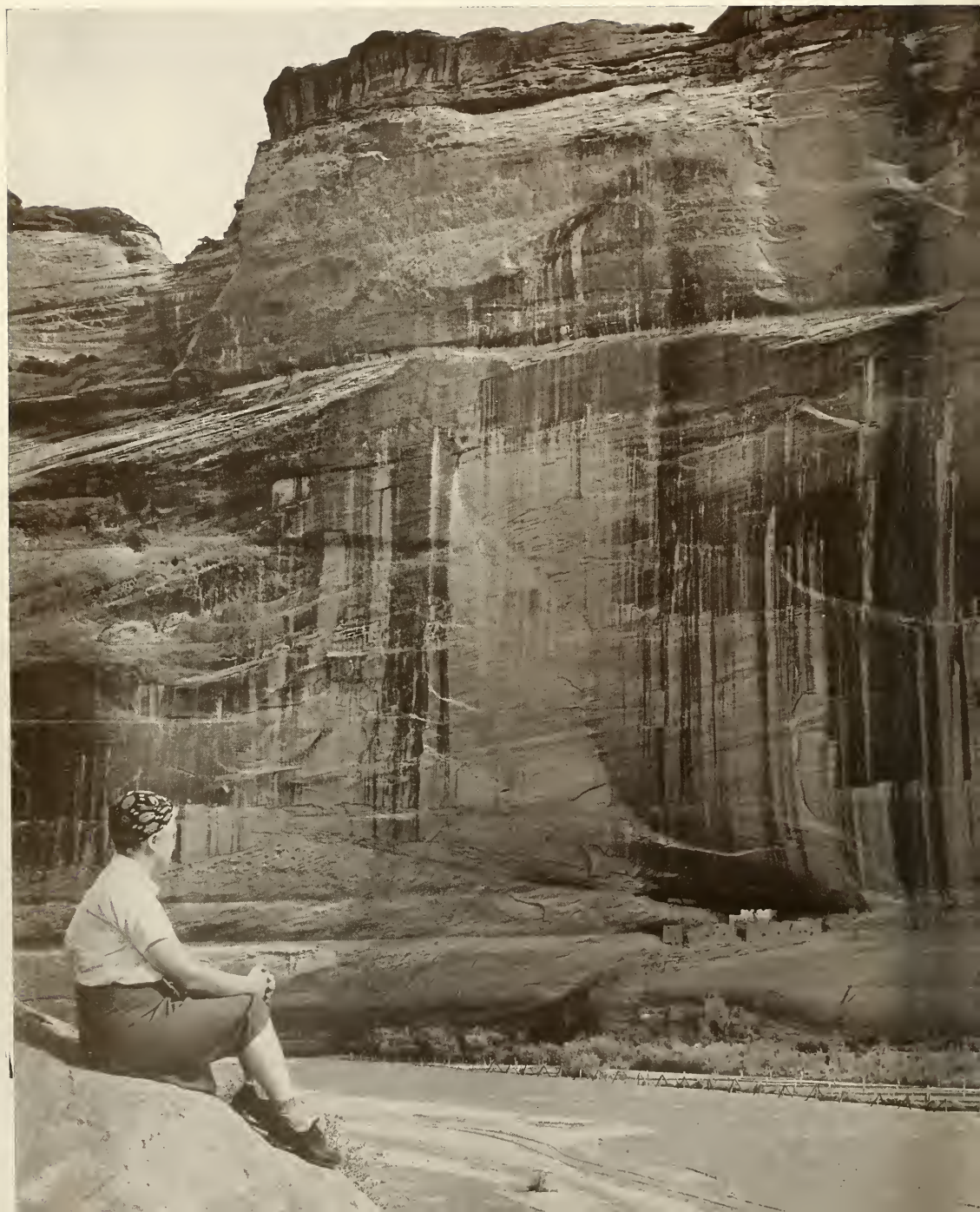
FRIDAYS over WNYC and WNYC-FM
from 8:15 to 8:30 P.M.

Science for Freedom

Conducted by MR. JULIUS POSTAL

▼ WHITE HOUSE RUINS. Set in a small niche in the face of a towering cliff are the ruins of the White House in Canyon de Chelly National Monument, Arizona. They are so named because the most protected portions of the buildings still have the white finish put on by the people who built them. Time has broken down the walls that connected the dimly seen lower structure to the upper

Cities



in the SUN

By JOYCE AND JOSEF MUENCH

BASKING in the warm Southwestern sun, untouched by strife, are hundreds of little abandoned communities that are oblivious to wars between nations. Their only inhabitants are the memories of a time before there was any "America." Yet in these hallowed structures, labored over by peoples that have disappeared from the earth, there was a civilization of beauty and simplicity, a communal life that has been traced and pieced together to weave one of the most fascinating stories to be found on earth.

Perhaps someday we shall know the whole story of the Southwest—whence came the people who first settled there and how the Basket Makers and Pueblo Dwellers influenced the pat-

tern of tribal life as it exists today. Layer after layer of refuse and building stones have been laid back by scientists, and piece by piece the puzzle fitted together. There are thousands more sites that are known but protected from the putterings of the casual explorer,—waiting to be scientifically sifted for clues.

The Southwest,—Arizona, New Mexico, and the southern portions of Utah and Colorado—, has a perfect climate for preservation. It has given us an area where stone dwellings still stand, some built in the open like Wupatki or Wokuki, others in canyons like Walnut Canyon or the Navajo National Monument ruins, protected by huge caves or dug out of the soft tufa as in Bandelier National Monu-

ment. Here dwell a prehistoric people who developed a civilization, lived here for several hundreds of years, and then disappeared leaving a possible line of descendants in some of the Pueblo Indians of today. The Hopis, Zunis, and Indians of Taos, Laguna, and Acoma are believed by some to be their descendants.

Here are pictured only a few, perhaps our favorites among the ruins that lie like the broken strands of a lovely old Paisley shawl upon the colorful country of the Southwest. Each ruin is unique in its location or its method of construction, but taken together they represent a priceless heritage. They point back to our early beginnings and make a joke of the idea that America is a "new" land.

▼ A CLOSER VIEW of the White House in Canyon de Chelly reveals the difficulty a modern visitor would have in climbing to the upper level. Note the difficult position chosen by some ancient artist who wanted

to decorate the rock wall with a pictograph. The ruins included in this area range from 348 A.D. (based on the earliest dated timber in the Southwest) to dwellings abandoned in the 13th century





▲ KEET SEEL, the cave of Broken Pottery, is the largest and one of the best preserved of the ancient cliff-dwellings. The only approach to the village is by the ladder

visible in this view, which is probably the type originally used. Keet Seel Canyon is in northeastern Arizona, within the area of Navajo National Monument

► MOST OF THE WOODEN BEAMS found in Keet Seel are the original timbers, which are valuable in dating the buildings by the tree-ring method. Annual growth rings in a tree are the "finger prints" of climatic change. A master chart, developed by Professor A. E. Douglas, shows the tree-ring pattern through many centuries. When the growth pattern of a specific timber is fitted into the master chart, the era of the tree is determined and the age of the building estimated. Thus it was more than 700 years ago that Indians hewed a great bridge log with stone axes and put it in place here. The ladder by which the village is reached can be seen ascending the rock-face at left





▲ MOONLIGHT ON BETATAKIN. In a tributary of Segi or Tsegi Canyon, one comes upon this cliff-dwelling after a hike of only a few miles. Here almost 150 rooms were built in about 1242 A.D. Always fascinating, the soft light of the moon adds

a bewitching touch to the deserted town near the very edge of the great cave that shelters it. The hand stones and metates used by the dwellers for grinding the corn they raised are still there. This is in Navajo National Monument, Arizona



◀ SOME 25 MILES east of Grand Canyon National Park we look out upon Nitsie Canyon from a large cave. Corn fields of the Indians are seen at left, and the peaceful hogan of a Navajo family is visible in the center of the picture. This cave shelters the famous Inscription House Ruin, which is said to get its name from the date 1661, carved by a Spaniard who was perhaps part of a military group that passed through the country. Navajo National Monument

▼ WOKUKI ("Big House") was built on a great rock not far from Flagstaff, Arizona, and at one time was a vantage point for watchers. Now it is deserted but still imposing—a three-story ruin that commands a fine view of the surrounding country





▲ At the WUPATKI NATIONAL MONUMENT, also near Flagstaff, portions of the ancient ruins have been restored, including the characteristic ladders leading from one level to another. Wupatki means "Tall House." The volcanic ash scattered over a thousand square miles by the Sunset Crater

eruption in about 885 A.D. made it possible for several generations to raise fine crops in the region. Then, after one of America's first great "land rushes," the wind and too many people seem to have ended the cycle of prosperity and the heavily populated villages were deserted



► **WALNUT CANYON NATIONAL MONUMENT.** This interesting canyon near Flagstaff, Arizona, was carved out by the same forces that created the Grand Canyon. In the little shelves protected by overhanging rocks are the ruins of cliff-dwellings built and occupied by Pueblo Indians from about 900 to 1200 A.D. The buildings cling to the canyon walls, part way between the water supply below and the fields the ancient people tended on the highland above the canyon



◄ **MONTEZUMA'S CASTLE.** Needless to say, the last Aztec emperor of Mexico never saw this impressive "castle" in central Arizona which bears his name. Comprising some 20 rooms, it towers about 40 feet high in the cave that protects it, and is in a fine state of preservation. The building was inhabited over 800 years ago

▼ **KINISHBA RUIN,** White River Valley, Arizona. Like the Phoenix, Kinishba has risen out of her ashes, under the patient hands of Dr. Byron Cummings and his Apache In-

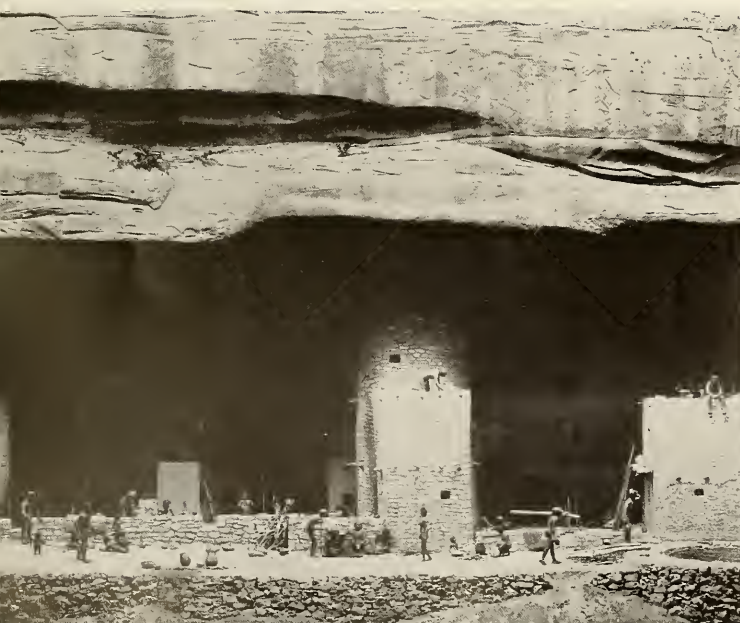
dian helpers. Here he is pointing out some of the interesting features of the "patio." Excavations indicate that the entire dwelling was built upon the ruins of an earlier one





▲ THE EARLIER of the two main cultural periods in the Southwest is known as the Basket Maker Period. Here the life of that period is depicted in a diorama on display in the museum at the famous cliff-dwelling site of Mesa Verde. The cave is only four feet high as represented in the model. It depicts the life of the early inhabitants before any kind of shelter was built by them

▼ THE SECOND PERIOD, the classic Pueblo Period, is portrayed in a similar model. In a typical cave shelter we see a restored dwelling, alive with the daily activities of its inhabitants, modelled to scale. Actual relics left by the ancient people enabled the artist to construct exact replicas of the pots, baskets, and weapons used centuries ago, Mesa Verde National Park Museum



► THE ANCIENT RUINS at Aztec, New Mexico, were never occupied by the Aztecs. The original occupants were related to the Chaco Canyon people, and these were apparently followed by people more like those who built the famous cliff-dwellings at Mesa Verde. The Aztec ruins were excavated by the American Museum of Natural History between 1916 and 1921. One of the larger circular chambers is 41 feet in diameter and was roofed over with timbers, probably for use as a place of religious assembly

► THE CHACO RUINS in northwestern New Mexico contain the largest apartment house in North America prior to the middle of the last century. This view from the mesa overlooking the ruins gives a clear impression of the shape and extent of the city that once flourished here. Its inhabitants showed the highest development in stone architecture to be found in this area. Here as elsewhere we see the large circular kivas or ceremonial chambers that suggest a well developed religious life among the prehistoric inhabitants of this area. Time erases many things. But the arid climate of our Southwest, which may have caused the abandonment of more than one settlement, has also preserved the clues to the story of man in this picturesque region. And the traveler, lured by the scent of juniper smoke rising from the Indian campfire, finds a new chapter revealed on each successive visit



Bird Babies of our Inland Shores



▲ REED-GROWN MARGINS of winding channels lead on into wide lakes. Their gleaming cobbled beaches and sandy strands are highways and homes of the shorebirds and cradles for the captivating babes of the shore. A scene in the Thompson Lake country, northwestern Montana.



BEACH BABIES: killdeer chicks

By JOHN L. BLACKFORD

*Photographs by the author unless
otherwise credited*

THE shore-world of pebbles and sand, of ooze and cracking mud, of waving cat-tail blades or matted tule stems is a varied and fascinating realm. It changes more drastically than most habitats with the seasons. Only in summer and autumn, after the lush aquatic and bog growths have sprung to full height, is there adequate weather-shelter or cover from searching predatory eyes. In winter, snow quickly blankets the low, fallen stalks, frost-rimed and sear, while ice seals adjacent waters. With spring, winged migrants bound for the far north pass along the wave-washed strand, but permanent residents do not arrive until fast-growing ranks of reeds and rushes once more appear. At all times of year beaches and mud flats are bare to the sweep of the elements; and their habitability departs along with the friendly temperatures of summer and early fall.

The struggle of beach birds and allied water fowl to maintain and increase their numbers during the brief span of summer's hospitality affords one of the most engrossing chapters of shore history. The extreme precociousness of the downy babes of the shore and their amazing adaptability to an unusual world, combined with uncommon winsomeness of form, all make for an acquaintanceship that is lasting and memorable.

These youngsters of beach and



Photograph by Winton Weydemeyer

▲ **SOON TO CLAIM** their age-old inheritance of sky and curving shore, young ring-billed gulls gather at sunset with their parents on the marge of Lake Bowdoin, a shallow prairie lake of eastern Montana. They depart in autumn from inland waters of Canada and the northern States and winter along our southern coasts

shingle, reedy pond and lush lake-margin, are of many lineages. Numerous waders of the heron tribe rear their young on water-logged platforms amidst cattail and tule. Mud hens, rails, grebes, and gallinules school fuzzy chicks among the weedy shallows. Terns and fresh-water gulls secrete their hopefuls within green mazes of the littoral, or upon shimmering sand close beside the waterline. Over the sand and the shingle or

across alkali mud flats, stilt-legged young of the true shore birds dart off at surprising speed. Infant neighbors of these downy sandpipers, willets, stilts, and avocets are the juvenile fleets of the water-fowl. And in guarded nests lie the blue-eyed babes of the short-eared owl and a helpless generation of marsh harriers. The accompanying "baby pictures" from inland strands show future scions of the ever-fascinating shore.

▼ **MIGRATORY WATERFOWL:** even in infancy these killdeer twins of the Malheur Migratory waterfowl refuge in Oregon wear the bold, distinctive, black-and-white pattern that marks the adult. The protective value of their markings is apparent whenever we attempt to detect the form of clever youngsters hiding motionless amidst the gravel in the glaring reflections and sharp, black shadows of the summer beach

▼ **THE BALL OF animated, gray fluff** that hatches from a spotted sandpiper's large egg is shortly able to run about. And the chick soon demonstrates the speed, self-reliance, and precocity that enables such a fragile bit of life to survive on the open, almost shelterless shore





▲ A SPOTTED SANDPIPER FLEDGLING seeks to escape discovery amid the beach drift of a sandy lake shore in northwest Montana. The narrow strip between wave-wash and shore shrubs, or the boulder-strewn bank of a river, will largely represent his path through life

➤ AS READILY AS A DUCKLING, the baby black tern will tumble from its low, soggy cradle in the reeds and paddle away to safety amid the labyrinth of crowding tule stalks. Middle Thompson Lake, northwestern Montana

▼ IN SPRING AND AUTUMN immense flotillas of waterfowl ride the watery reaches of Bear River Marshes, Utah. While the waving cattails and cane grass are at their midsummer height, fledglings of the sora, coot, bittern, and ibis explore its mysterious mazes, and young stilts and avocets track its muddy margins

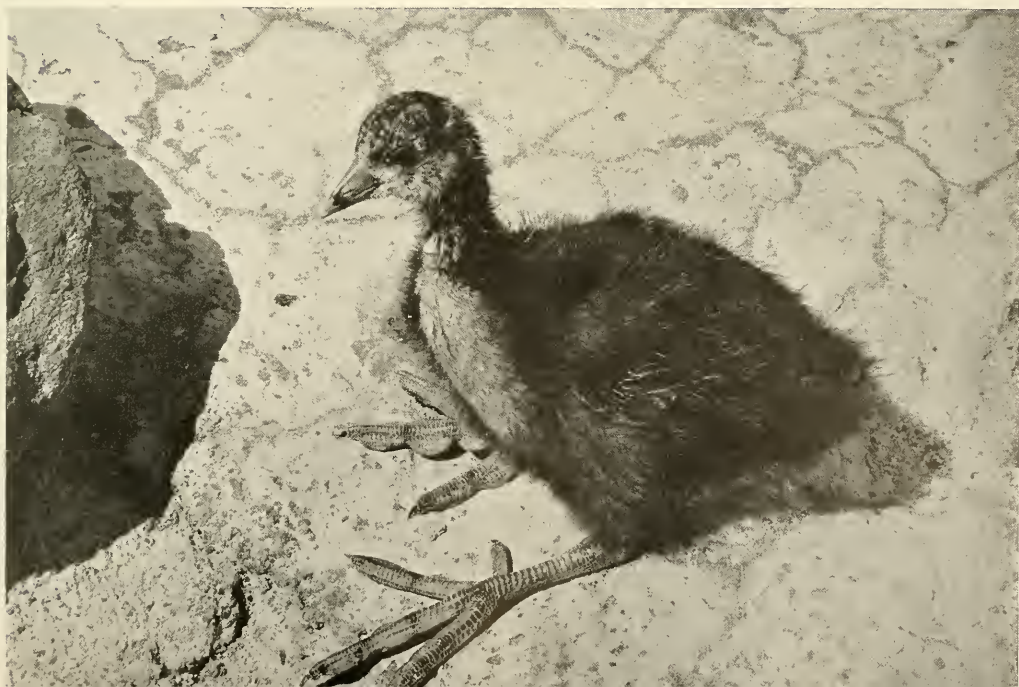




▲ INCUBATION of coot eggs begins before the clutch is complete. This installment-hatching ensures the mud hen at least a partial brood during the short, dangerous nesting season. Like many other babes of the reedy littoral, coot chicks take to the water

soon after the natal down is dry. As they leave the nest, the male assumes their early care, leaving his mate free to continue incubation of remaining eggs. Bear River Marshes Migratory Waterfowl Refuge, Utah

▼ THE BROADLY LOBED FOOT of the young water chicken is another of the wonderful adaptations displayed by shore dwellers. They fit the infant coot for life on oozy mud banks and on open water. Bear River Marshes, Utah





◀ A YOUNG CITIZEN of the shore demonstrates his amphibious footgear. He crosses the quaking blue ooze of a bog as readily as its banks of dry, cracking mud

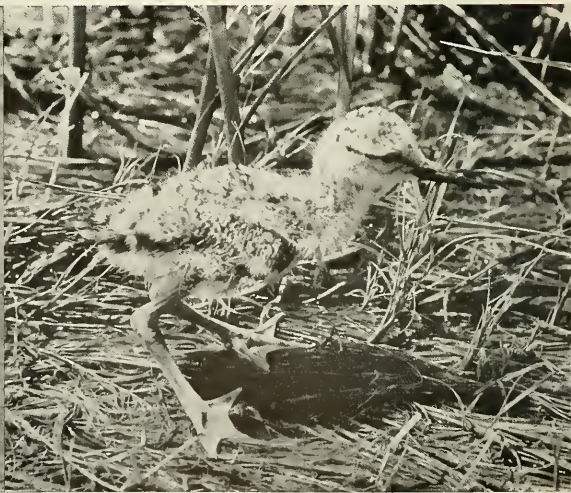
➤ FLESH-COLORED LEGS and the absence of a web between inner and middle toes distinguish a youthful black-necked stilt from a young avocet. The dainty stilt at Bear River Marshes, Utah, is inclined to police the inshore waters, leaving his blue-shanked cousins to adventure belly deep or glean from muddy bottom beyond with head under water



▼ FLATTENED upon a sun-baked mud flat of the Bear River Marshes, the avocet chick has effective color-pattern protection against the featureless brown or blue-gray surface and meager vegetation. Long legs will carry this infant away at startling speed



✧ A LITTLE OLDER, this avocet finds a region of adventure and delight in the reedy shallows swarming with minute aquatic life





▲ LONG before losing his juvenile plumage a young avocet acquires the stilt legs and long, up-curved bill with which his kind wade and sweep the shallows for aquatic insect life. His destruction of midge and mosquito larvae, as well as of diving beetles, enemies of game-fish fry, is only part of the invaluable service shore birds render in patrolling lakes and waterways. Bear River Marshes, Utah

➤ ON ISLAND LAKE, western Montana, fleets of waterfowl ride the open, rippling water. Coots dabble among the nearer lily pads, and many babes of the shore and marsh follow the oozy edges and hide in the tall tule and cattail borders





Spring Beauties

By **THANE L. BIERWERT**

*Acting Chief, Division of Photography
American Museum of Natural History*



FALSE SOLOMON'S SEAL. Note the shadow of the flower falling across the leaves



MARSH MARIGOLD, often called cow-slip in the United States



PINE NEEDLES. (lower left) were inserted to show the size of the pixie cups

GET out while the weather is fresh and bracing, while your foot is still itching to go places after being cooped-up all winter. May is the time of year to see the spring and summer flowers. To be sure, flowers are found in fields and woods during other months; but May is the best month for the woodland flowers from a photographic viewpoint. We don't have to work quite so hard or wait so long to get sunshine on the blossoms. "Why is that?" you may ask. For the very simple reason that the leaves of many of the trees are still not fully developed until near the end of the month and more sunshine reaches the floor of the forest. The ground is still soft and moist enough to prevent the formation of dried leaves. Smooth backgrounds are possible because many shrubs have not come into full leaf. Yes, to make our best flower photographs we should begin early in the season, and May offers the best conditions of any month.

Unless we know the flowers well, it is best to bring along a good flower book in order to identify our finds. Since there are many excellent ones available, it is wise to buy the book that explains completely about habitat and flower parts. After all our grandchildren can use it someday, too.

There are dozens of beauties that we are sure to find in the woods which will make

excellent black and white pictures and even better Kodachromes. Among these are the jack-in-the-pulpit with its three leaves and hooded spathe, the many violets, the golden marsh marigold, the delicately flowered forget-me-nots, the pale spring beauty, the spectacular golden club, and the beautiful mossassin flower, both yellow and pink. On drier areas we can find the ground-covering May apple, the common buttercup, earth hugging pixie-cup, two prize finds: Dutchman's-breeches and Solomon's seal, as well as star grass, wood anemone, wild geranium, and wood pink. Each and every one lends itself to a striking photograph. But, how to go about it?

Our equipment need not be complicated. However, even beyond camera and film, there are some pieces that are indispensable. First we require a tripod that will bring the lens of the camera down to within five or six inches of the ground. Why so low? In order to see the blossoms of some flowers we have to get down to "plant eye-level." If our standard tripod does not have wide-spreading legs or collapse enough, one of the table-top tripods can be used, or if the facilities are available we can make one to suit our needs. Another aid is a close-up lens: portrait attachment, Portra-lens, Proxtar or spectacle lens. With this we can fill our format area with a detail of the flower head and really see what's there. A cable release for the shutter will insure sharp results by eliminating camera shake. An exposure meter, while helpful, is not at all necessary, since the exposure guides are extremely accurate if used intelligently. Last among the imperatives is a ruler of the folding variety at least three feet in length. This is really all we need as foundational equipment—not a very great outlay when we stop to analyze the items. Oh, yes, one thing more. How about someone to go with us to carry the book, tripod, and extra film? A better job can be done if we need not concern ourselves with scrambling around to collect our belongings when moving on to a new location.

Let's get to work. It's a crisp, clear day and we and our "slave" have found an excellent flower to photograph. Direct sunlight is completely illuminating the front of the blossom. This lighting is too harsh and uninteresting, so we select a point almost at right angles to the sun and looking into the deep woods, which will make a good background for our flower (the other direction points our camera toward the open meadow beyond, making a spotty background). A No. 2 Portra-lens or Proxtar lens is selected, slipped over the lens of the camera, and we can now work at a distance of about nineteen inches from our subject. To work closer, thirteen inches or so, select a No. 3 supplementary

Continued on page 240

NATURAL HISTORY, MAY, 1944



VITAL vegetable oils

By HAROLD N. MOLDENKE

Wartime research throws light on lowly plants that smooth the path to victory and pave the way for a more abundant peace

VEGETABLE OILS perform so many unsuspected functions in numerous chemical processes and in the lubricating and protecting of surfaces, that the average person does not usually know the seriousness of shortages. Much of the world's normal supply of vegetable oils has been cut off by the war.

On a basis of their physical condition, widely different kinds of substances are called oils, and they are derived, of course, from animal, vegetable, and mineral sources. The animal oils were probably the first to be used by man; even today the Eskimos depend upon seal oil for heat and light. Mineral oils, fairly recent in man's economy, have strongly influenced the pattern of modern civilization. But vegetable oils, even though we do not so often encounter them in recognizable form, make possible a great many things that have come to

be regarded as essential in modern life.

We should remember the difference between fatty (or fixed) oils and essential (or volatile) oils. All the commercially interesting fatty oils of vegetable origin are obtained from seeds, with the exception of olive and palm oils. The terms "fats" and "fatty oils" apply to those that consist almost entirely of mixtures of glycerides, which are chemical combinations of various fatty acids with glycerine.

The essential oils, depending on the kind, are found in the roots, stems, leaves, buds, blossoms, seeds, and some fruits. They are, with few exceptions, complex mixtures, which may include alcohols and their esters, aldehydes, ketones, hydrocarbons, and other substances.

Many new products are made from fatty vegetable oils, including detergent (cleansing agents), wetting and emulsification agents, protective coat-

ings, and lubricating mixtures. Large quantities of certain oils formerly imported are now cut off by the war, and this has necessitated to no small extent the substitution of other oils, some of which have been obtained locally and others chiefly from South America.

The demand for what are called *drying oils* has grown enormously since the beginning of the present war. Not only have many of the sources been cut off, but there is greater need for these products in the war effort. The industrial consumption of drying oils in the United States expanded from 640 million pounds in 1940 to 900 million pounds in 1941. The principal oils used in the United States for drying purposes in 1941 were, in millions of pounds: linseed, 670; tung, 49; castor (dehydrated), 44; soybean, 42; fish, 41; oiticica, 40; and perilla, 5.



U. S. Department of Agriculture photos

▲ CLUSTER OF TUNG FRUIT. About two or three inches wide and shaped like a tomato, the dark olive-green fruit of the tung tree yields the most important of all the drying oils. In 1941 the United States used about 49 million pounds of tung oil. All supplies are restricted to war use

Probably the most important of all the drying oils is tung oil. In 1940 about 95 per cent of the tung oil used in the United States went into paint and varnish industries. Its drying speed and water resistance are second to none. In addition to being employed in paints for battleships and many other war purposes, tung oil has strategic uses in the production of certain insulating compounds for electric generators, cables, and wires. It is an important ingredient in many types of brake linings and on gaskets for steam pipes, pumps, and engines. It is used in the manufacture of linoleum and oilcloth and for waterproofing fabrics. Government regulations now restrict all existing supplies to war uses.

The most important source of tung oil is the "China wood-oil tree" (*Aleurites fordii*), native to central and western China. A closely related source is *A. montana* of southeastern China, whose oil is so nearly identical that no distinction is made commercially. Oil differing from true tung in certain important qualities comes from the "Japanese wood-oil tree" (*A. cordata*), cultivated in southern Japan and Formosa, and from *A. molluccana* and *A. trisperma* in the Philippines.

Before the present war China was the only large tung producing and exporting country. Farsightedly the United States Department of Agriculture in 1905 began experimenting with tung cultivation in America. By 1940



there were over 12,500,000 tung trees in the Gulf Coast States, Georgia, and South Carolina. Argentina, Brazil, Paraguay, and Uruguay are also producing tung oil in commercial quantities. Experiments in its production have been undertaken widely in the Caribbean area but without much promise. A distinctly cool winter is beneficial for tung trees, which do best if dormant for three or four months each year.

The tung tree (*A. fordii*) attains a height of about 40 feet or more and an age of about 35 years. Because of its handsome appearance, it is often planted for ornamental purposes. Numerous clusters of snow-white or pinkish flowers are produced in spring and are followed by broad, dark-green leaves. The flower cluster is made up of one or more female flowers surrounded by a large number of male flowers. The tree normally begins to bear fruit at about the third year and should be in full production by the sixth or seventh. The dark-olive green fruit is two to three inches wide and shaped like a small tomato; it turns to dark brown at maturity. The outer

husk encloses some three to seven seeds or nuts resembling a castor-bean in shape and color. Ripe fruits fall to the ground and are then gathered and air-dried to remove most of the moisture. In milling, the hard shell is removed, and the white, oily kernel is ground to meal. Then it is heated and put through an expeller to press out the oil. About 320 pounds of oil are extracted from a ton of air-dried whole fruit, but the yield varies.

There is an invaluable substitute for tung oil that is not even mentioned in most dictionaries—oiticica oil. It is now used for almost all military purposes where tung was formerly used, especially as a corrosion resisting coating for airplanes, guns, and ships. It is also used for electrical insulations, brake linings, clutch facings, food-container coatings, chemical resistant finishes, waterproof adhesive binders, and in the manufacture of resins. In peace time it served as a component of pressed fiber boards, fiber bags, and linoleum.

The oiticica oil industry is a Brazilian monopoly. In ten years oiticica has risen to become Brazil's eleventh

most important export commodity. Earlier efforts, dating from more than a century ago, failed to develop it commercially, and the first successful production was not achieved until 1930.

The oiticica tree is related to our cherries, plums, and peaches and is the only large native tree in the grasslands bordering the rivers and brooks in northeastern Brazil. It is a long-lived evergreen tree, which may grow to 100 feet or more in height. It is characteristically well-grown and round-headed, and it often grows in large stands, rather than singly. The outer branches frequently hang almost to the ground, where they may take root and form natural arches. The fruit is harvested from January to April, the single seed containing from 45 to 50 per cent oil. The seed is easily removed from the enveloping husk, and the oil is expelled by pressure with or without the action of solvents. The oil possesses a very unpleasant odor and is semisolid at ordinary temperatures. These properties greatly restricted its use until means were found for refining it and keeping it liquid.

➤ A FOUR OR FIVE YEAR OLD TREE. The tung tree (*Aleurites fordii*) attains a height of 40 feet or more and an age of about 35 years. It normally begins to bear fruit at about the third year and should be in full production by the sixth or seventh



▲ NUMEROUS CLUSTERS of snow-white or pinkish blossoms appear in spring and are followed by broad, dark green leaves. The flower-clusters are made up of one or more female flowers surrounded by a large number of male flowers



A Brazilian writer says: "One who has traveled through northeastern Brazil in the year of a drought will never forget the sweet, cool, friendly shade of the leafy oiticica, which nature seems to have created to thrive just when all other inland vegetation is scorched and dried by the hot winds from the parched *catingas*. For many years the oiticica was used merely as a shade tree. The picturesque troop trains of the Northeast always rested in its ample shade. Under its evergreen leaves, countless travelers forgot for a time, while enjoying a pleasant rest, the inclemencies and annoyances of a hostile Nature and an exhausting climate. The oiticica was then used for no other purpose; even its wood was not exploited, and yet thousands of oiticicas dotted the monotonous landscape, amid the vast and desolate ash-colored fields."

Oiticica oil is used not only as a substitute in many cases for tung oil but also for some other drying oils. The production in Brazil increased 20 times in the three years ending 1938. This great increase has been due to more extensive gathering of seeds from wild trees. But experiments are also being conducted to produce high-yielding strains. Oiticica trees do not mature nearly as fast as do tung trees, and though cultivation is being undertaken on a sizeable scale, it will be years before the planted trees will produce what would be considered a commercial size crop. However, the seedlings budded from high-yielding trees begin to bear several years earlier than those not budded, and are being supplied in quantity to prospective growers.

An oil that can serve similar purposes comes from another tree of the same genus, *Licania arborea*, native to southern Mexico and Central America.* Like the Brazilian oiticica, it is found growing in open situations and not in regions covered with dense forests. The fruits and the kernels (decorticated seed) are about half the size of those of the oiticica tree. The kernels contain about 68 per cent of oil. The strong drying properties of this oil and its similarity to oiticica were only recently discovered in the United States. Both of these oils are semisolid at ordinary temperatures, but heating them to 210-225° C. for 20 or 30 minutes renders them permanently liquid so long as they are kept stored in well filled, tightly closed containers.

Another tree of Mexico and Central America whose nut appears to have properties as a drying oil is *Lonchocarpus roseus*. Its oil is burned by the natives as a source of light, and from it is extracted a fatty acid useful in making candies. Preliminary reports indicate that a total of 1200 tons a

*This tree is called the cacahuananche in Mexico, the alcornoque in Costa Rica, the encina in Honduras and Guatemala. Elsewhere it is known as the cana dulce and guirindal.

year could be obtained in the state of Guerrero alone as a substitute for tung or oiticica.

Rapeseed yields a thick, nondrying or semidrying oil and is produced in large quantities in Asia as well as in various parts of Europe. This plant (*Brassica napus*) is well-known as the source of an aphrodisiac bird food, and it is grown as a forage crop for sheep and hogs. The oil is used in the United States in considerable quantities in sacramental lamps and, after blowing, in the preparation of certain lubricants for machinery. In the Western Hemisphere, Argentina has been the largest producer. Steps are being taken in Mexico to increase rapeseed production materially.

High in the ranks of strategic vegetable oils is castor oil. Our younger readers will probably be surprised that the familiar household use to which it is put accounts for only about one-tenth of the total quantity produced annually. No substitute has yet taken its place as a hydraulic fluid such as is used in retractable landing gear. It is used in the manufacture of sulfonated oil, large quantities of which are employed by the textile and leather industries. It also has a place in the production of certain "perfume aromatics," of sebatic acid (required for

➤ THE RIPE FRUITS, now dark brown in color, fall to the ground and are gathered and air-dried to remove most of the moisture. About 320 pounds of oil can be extracted from a ton of air-dried whole fruit, but the yield varies



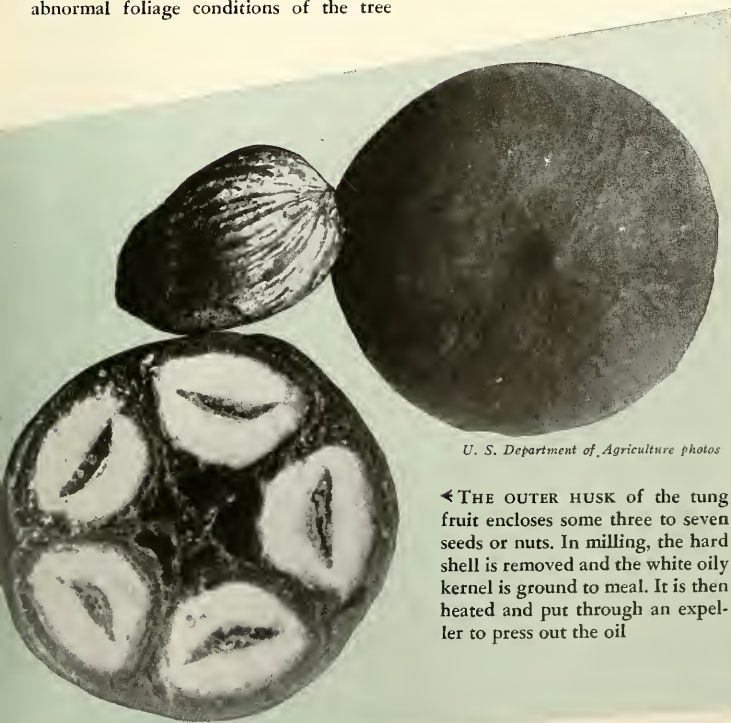
making nylon, from which parachutes are made), certain soaps, typewriter inks, sticky fly papers, cellulose baking enamels, and imitation leathers. After being blown with air it is used in making lacquer paste colors and for purposes where a plasticizing oil is required.

Castor oil has no drying powers, and that accounts for its usefulness as a lubricant. Only after conversion into hydrated castor oil, sold under various trade names, is it useful as a drying oil. For certain purposes, the dehydrated oil serves more or less as a substitute for the notably stronger drying tung oil. Unlike the stronger drying tung oils, it has been found particularly satisfactory for use in mak-

► BEFORE WORLD WAR II China was the only large tung producing and exporting country. But the U. S. Department of Agriculture realized the value of this oil, whose drying speed and water resistance are second to none, and in 1905 began experimenting with tung cultivation. By 1940 there were over 12,500,000 tung trees in the United States. In diagnosing the nutrient deficiencies and requirements of the tung tree Dr. F. S. Lagasse (above) studies abnormal foliage conditions of the tree



U. S. Department of Agriculture photo by Forsythe



U. S. Department of Agriculture photos

◀ THE OUTER HUSK of the tung fruit encloses some three to seven seeds or nuts. In milling, the hard shell is removed and the white oily kernel is ground to meal. It is then heated and put through an expeller to press out the oil

ing white enamel for various hospital and home equipment, including refrigerators. Since 1937, increasing quantities have been used for this purpose, as well as for making protective coatings and overprint and lithographic varnishes for the printing industries.

Before Pearl Harbor and the huge expansion of airplane production in the United States, there was a considerable shift to castor oil as a substitute for tung oil. Imports were mainly from Brazil and the Far East. Now large quantities are used for certain secret military purposes, principally by the chemical warfare service.

The castor bean (*Ricinus communis*) is found growing wild and is cultivated at least to some extent in most inhabited tropical and semi-tropical regions. In view of the importance of the oil for many technical purposes, plans have been made for planting about 10,000 acres in eight midwestern and southern states.

In recent years, great expansion has taken place in the acreage planted to castor beans. The collection of beans from wild plants in Brazil is sensitive to market conditions. Only in years when a strong foreign market brings good prices, are the beans harvested extensively from the widely scattered

wild stands. The United States has been Brazil's chief castor bean customer for some years. For the time being, increased imports to the United States have permitted relaxation of restrictions on civilian uses of castor oil. Almost all of the imports come in the form of seed. This enables the castor pomace, which remains after the oil is extracted from the seeds, to be used as fertilizer. Mexico, on the other hand, has extensive oil milling facilities and the Mexican Government is encouraging farmers to grow castor beans, since the climate is considered well adapted. Other imports are coming from Haiti, the Dominican Republic, and several other Latin American countries.

Another possible source of a very strong drying oil which recently has been investigated is that found in the seeds of the tree *Garcia nutans*, a member of the Euphorbia family. The tree grows wild in some parts of Mexico, Central America, Colombia, and Venezuela. In Mexico it is called pinonchillo, and in other countries it is known as the pascualito, avellano, and pepita del indio. The so-called nuts, obtained from Mexico, which look like small brown mottled marbles, consisted of 80.5 per cent of oil and 19.5 per cent shell. The expressed oil not only resembles tung oil in appearance but is found to be of similar composition and to possess the same valuable properties. Experiments indicate that it is even faster drying than tung oil.

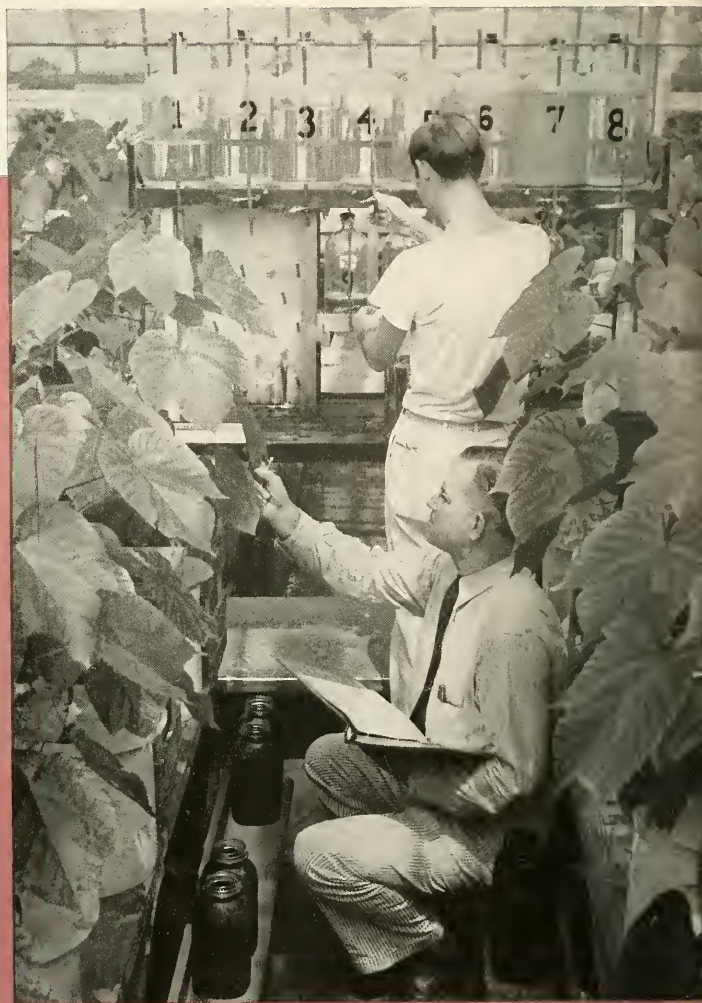
Whether or not any quantity of the nuts from the current crop can be collected in Mexico or elsewhere remains to be determined. In view of the remarkable properties of the oil, experiments for the cultivation of the tree will be undertaken.

In Ecuador collection of the nuts of a palm known locally as "palma real" or "wine palm" (*Ynesia colenda*) has been greatly stimulated since the outbreak of the war. The tree grows wild in the forests, and the kernels yield an oil similar to that from other palm kernels, including coconut oil, and can be used for the same purposes. About 1500 tons of the nuts were gathered in 1941—probably twice that amount in 1942. Chile was at one time the only foreign buyer, but now Panama and the United States are buying these palm kernels at such a rate that Ecuador has had to impose regulations to assure that the local needs will first be satisfied.

Large scale expansion of vegetable oil production in Argentina is also helping to overcome the Western Hemisphere's deficiency in these strategic commodities. Argentina's exports of vegetable oils jumped from 7500 tons in 1940 to 121,000 tons in 1942. The greatest expansion has been in sunflower seed oil (from *Helianthus annuus*).

A motor fuel called jeanite is now

produced from blackstrap molasses obtained from sugar cane (*Saccharum officinarum*). While not competitive in price with gasoline, the product is believed to have potential value for the several American republics that have no petroleum but do have sugar cane industries. Most other experiments in the use of grains and similar products for motor fuels have involved the production of alcohol for blending with



U. S. Department of Agriculture photo by Smith

▲ THE CULTURE NEEDS of these foreign tung trees are studied to aid in the commercial plantings in this country. In a greenhouse at Beltsville, Maryland, tung trees are grown in sand culture to determine their nutritional requirements and symptoms of malnutrition

gasoline. The new process avoids this objection by producing entirely from molasses a fuel that is practically identical with gasoline in fuel value and octane rating.

On rich lands in Mexico and Nicaragua, sesame (*Sesamum indicum*) is now being cultivated for its vegetable oil. Formerly it was imported almost exclusively from India and China; now it is an important export crop in the above-named Latin American countries, and further studies of its possibilities are planned.

Still another important vegetable oil is chia oil, derived chiefly from *Salvia hispanica*. It is employed in the manufacture of varnishes. In quality it is quite comparable to perilla oil and can be substituted for it. Varnishes



U. S. Department of Agriculture photo by Forsythe

FLAKED MATERIAL obtained by flaking tung fruit kernels is being weighed on a balance at the Gainesville, Fla., station of the Bureau of Plant Industry. Tung oil is of strategic importance in the paint on battleships, in the brake linings of jeeps, and in the waterproofing of fabrics

Other Essential Oils

GERANIUM	HEMLOCK
CLOVE	CEDAR
LEMON	BENZOIN
SANDAL	LABDANUM
SASSAFRAS	HYACINTH
ANISE	VIOLET
CARAWAY	CAMPHOR*
ANGELICA	PETITGRAIN
SPEARMINT	LAVENDER
PENNYROYAL	VETIVER
ROSEMARY	NEROLI
SAGE	JASMINE
THYME	CASSIA
CINNAMON	ROSE
TUBEROSE	BERGAMOT
YLANG-YLANG	PINE
PEPPERMINT	FENNEL
EUCALYPTUS	PYRETHRUM
BOLLO	CORIANDER
FENUGREEK	BORAGE
WHITE MUSTARD	SAFFRON
POPPY SEED	MAJORAM
GOAT'S RUE	RATANY ROOT
SAGE	LEMON-GRASS
SOAB BARK	COPAIBA
ALLSPICE	LINALOE
BALSAM-OF-PERU	GUAYACO
TOLU	CAYENNE
FIR	LINALOE OIL
LAUREL OR BAY TREE OF WEST INDIES	

*To be discussed later.

made with it are given unusual luster. Its natural range extends from western Texas southward through the high tablelands of Mexico to northern South America. Attempts to grow it in several of our southern states failed. Yields on commercial plantations run up to 1115 pounds per acre, but the average is about 440 pounds. It is possible that after the war chia oil from Mexico may supplement supplies of linseed and other drying oils essential in the economy of the United States and other industrial nations.

The class of oils known as *essential oils* derive their name from the fact that they contain essences or have the nature of essences. They are used in perfumes, cosmetics, medicines, and soaps, where they provide scent, flavor, or other qualities having sales appeal. Many of these oils could be produced profitably in the Americas for the United States market.

Space does not permit discussing them here in full. Lemon-grass oil (from *Cymbopogon flexuosus*), was formerly imported from India and is important for perfuming inexpensive soaps and as a source of citral in perfumery and flavoring. Half a million pounds were imported annually before the war. Citronella oil comes from a fragrant grass native to Ceylon

and Java (*Cymbopogon nardus*) and is widely used in soaps and insect repellents. It is extremely important for the chemicals isolated from it, including geraniol, citronellal, and menthol, the first two being used in perfumery and the latter in medicine. Japan used to be our chief source of natural menthol, but for some years mint oil, the source of menthol, has been distilled from Japanese mint grown in one or more of our northwestern states; and today we are leaning heavily on menthol from citronella oil produced in Puerto Rico and Haiti.

Other essential oils are listed in the table at the left.

Thus we see that natural oils, obtained from lowly wild and cultivated plants, are not only of tremendous value on the home-front in the perfumes of milady's toilette, the flavorings on dinner-tables, the ingredients of soaps and medicines, the shoes and raincoats we wear, and the linoleum on our floors, but often are also of strategic importance in the nylon of an aviator's parachute and the paint on a cannon or battleship, in the brake-linings of jeeps and the landing-gear of bombers.

[Next month: camphor, wax, stockfeds, vegetable-ivory, chicle, gourds, charcoal, vitamins.]

LETTERS



◀ **T. M. Longstreth** tells you how to be your own weather prophet. An invaluable book for amateur meteorologist, or anyone interested in aviation. Illus. \$1.69



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MACMILLAN

60 Fifth Avenue New York 11, N. Y.

SIRS:

I was interested in reading "The Tail End of Creation" in the April issue of NATURAL HISTORY, and when I saw the comment that "more than 200,000 square miles of Idaho are covered with black lava" I suspected a slip-up on the part of somebody. . . . The area of Idaho is 83,000 square miles. . . . C. T. E. BARLOW.

Newark, N. J.

SIRS:

"... 200,000 square miles of Idaho are covered with black lava!" . . . I am wondering if flights of fancy do not sometimes creep into NATURAL HISTORY Magazine.

Glen Ridge, N. J.

R. D. BONNEY.

SIRS:

"... 200,000 square miles . . . That would be 128,000,000 acres. . . .

Washington, D. C.

N. H. WHEELER.

The statement "more than 200,000 square miles of lava" is correct, but the area should have been defined as extending beyond the boundaries of Idaho. The Idaho lava plain unites to the westward with the Columbia River plateau, and together they form a vast lava field over 200,000 square

miles in area. This is surpassed in size only by the Deccan traps of India and the Paraná lava field in South America.—Ed.

* * *

SIRS:

I want to thank and congratulate you on the splendid series of articles by Dr. Harold N. Moldenke, which you have been publishing in recent months. Although I am a mere layman, I have read them with great interest and profit, and am impressed by what I recognized to be the authoritative character of these writings. Their timeliness is obvious. You are editing an able and very beautiful magazine, and Dr. Moldenke's articles have been an impressive feature.

JOHN HAYNES HOLMES.

The Community Church of New York, New York City.

* * *

SIRS:

"... Is there any way of keeping bats from flying in and out of your porch on summer evenings? They seem to pop up every summer, and it's not pleasant. . . . They have also gotten into the house on occasion. Is there some sort of deterrent one could use? . . .

RALPH E. FIGERT.

Wooster, Ohio.

If a bat enters the house, darken the room and place a light outside the open window. The light will generally attract the bat to freedom. Occasionally, when bats roost in numbers in a house, they may become troublesome. In that case their entrance may be closed up during the night while the bats are away. A quantity of moth balls placed in the hole will generally cause the bats to move to other quarters. However, the occasional bat that flies across the porch on a summer's evening is doing a service and should be welcome. The bat is undoubtedly chasing insects that have been attracted by the lights of the house. He will harm nobody; all the disagreeable and fantastic tales about our bats have no foundation of truth. Bats that enter the house should be caught unharmed and liberated, for bats are true friends of the farmer and gardener.—Ed.

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BOOKS

Continued from page 199

successful job of making clear, as darkly clear as it can be in some instances, the processes that go on inside the minute particles of which matter is made.

First in the book come Mr. Tompkins' three dreams, of which the protagonists are respectively Maxwell's Demon, The Gay Tribe of Electrons, and the Wood-carver who makes and explains to Mr. Tompkins the various kinds of nuclei which form the keystones of the different types of matter. These dreams are the "fanciful-though-real" part of the book, and make the last four sections, the four lectures which inspired Mr. Tompkins' dreams, more understandable. These lectures are listed as follows: The Reality of Atoms, Inside the Atom, Holes in Nothing (dealing with the famous theory of the young British physicist, Paul Adrien Maurice Dirac that "There should be holes in empty space"), and The World Inside the Nucleus.

Anyone recommending this book as light reading for the average person would be making a grave mistake. It is, however, the most readable and understandable book I have seen about the basic nature of matter.

MARIAN LOCKWOOD.

CLINICAL TROPICAL MEDICINE

- Edited by Z. Taylor Bercovitz

Paul B. Hoeber, Inc., \$14.00

SINCE the outbreak of the present conflict and the dissemination of American soldiers over the tropical regions of the world, interest in, and the need of knowledge of diseases peculiar to the tropics has increased enormously. Before the war few American doctors had any expectation that they would be called upon to recognize diseases of foreign or tropical origin. The demand for courses in tropical medicine and literature on the subject was limited to a small number of men whose prospects might lead them to the tropics, or who might have been interested because of some urge which they themselves did not fully understand.

The advent of war created a problem which the medical profession was not equipped to handle. It is true that mosquito control and malaria control were receiving considerable attention, but malaria is chiefly a disease of the tropics and the south temperate regions. The great majority of our doctors had never been called upon to diagnose a case, and extremely few had ever seen yellow fever. These are the two best known of the tropical diseases but they are only two of many. Many of the tropical diseases are still too little understood for ready diagnosis, and this may be complicated by the presence of more than one disease, a condition that might greatly influence the treatment.

In *Clinical Tropical Medicine* the contributors, of whom there are 27, all with experience in one or more regions of the tropics, present briefly and clearly the known facts concerning the various diseases, including symptoms, diagnoses,

treatment, prevention, etc. In each case the methods of arriving at diagnoses are described and there are copious illustrations of the disease organism, diseased tissues, and physical appearance of the disease when such is apparent.

Since insects and their relatives are the carriers of most of the tropical disease, and some are the actual cause of a diseased condition, these creatures also receive attention, and so do venomous reptiles.

We believe that this is the most comprehensive single volume on these diseases. It is intended primarily for medical men and should have a place on the shelves of doctors' libraries for ready consultation when our men return from overseas. Certainly it contains much of interest and vital importance to the layman, but its chief use will be among those with a scientific background or medical interests.

C. H. CURRAN.

RACE AND RUMORS OF RACE

----- by Howard W. Odum

The University of North Carolina Press, \$2.00

EVERYONE knows or should know that the tensions between Negroes and Whites in the United States have developed to a particularly alarming stage. The irritations, resentments, injustices, and misunderstandings which in the past have kept the relationships between these two groups quietly simmering have been intensified by the increasing tempo of social readjustments brought about by the war. As a result the years 1942-43 were ones that were full of hazards and symptomatic of dangerous pressures. In a situation already delicately balanced, the intrusion of rumor was especially dangerous, since the will to believe gave the status of truth to all manner of idle gossip and third-hand rumor.

Professor Odum has in his book gathered together samples of these interracial grievances in the South and the rumors that reflect them. He has limited his portrait to these initial war years quite deliberately and has written of them in the past tense even though the conditions he describes continue to the present. He not only examines the biracial folkways of the South but also considers the effect of wartime economies, of Northern agitation, of Federal measures of amelioration, and of various other greater and lesser social movements that have contributed to the total picture. He pleads earnestly for moderation, for understanding, and for patience. He asks that the problems be seen in the light of southern folkways and that the solutions be adjusted to them. His book is honest and courageous, and it is to be hoped that his wise counsel be followed.

If he accomplishes nothing more than to reveal the absurdities of rumor and to arm us with skepticism for all its forms, he will have accomplished much. Rumor repeated often enough acquires an authenticity that defies the truth.

H. L. SHAPIRO.



This is the Longines watch of Harold Gatty, who recently completed "The Raft Book," a life-saving guide for men adrift at sea. Gatty's Longines watch first served him when he navigated the electrifying round-the-world flight of the airplane "Winnie Mac" with Wiley Post in 1931. Since then it has been a friend and companion on a hundred air adventures. We are proud that the flyers of today, like Gatty and the other great pioneers are of one mind about watches. They say "For navigation . . . Longines is tops."

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PEOPLES OF SOUTHEAST ASIA

----- by Bruno Lasker

Alfred A. Knopf, \$3.00

I SUPPOSE it came as a shock to many people to discover from the realities of the war that Southeast Asia, far from being a happy, picturesque world remote from the tensions of modern life, was in fact an area of profound maladjustment. The travel literature, the tourist blurbs, and the official propaganda had contrived to create a highly glamorized version of native life that for most of us represented the facts. How discrepant was this view from the actuality becomes all too obvious from a reading of Mr. Lasker's book.

Having devoted many years to a close study of native economy he speaks with authority on the main currents directing the development of Southeast Asia. To make them clear, he discusses the nature and variety of native life, from the hill tribes of Burma to the jungle folk of Borneo. He traces the influence of China, Arabia, and India in creating the civilizations of the past. He dissects the economy of the present with its multifarious influences, of which the colonialism of the western world is only one among many. He appraises the policies and programs of the European mother countries in the development of native life and indicates their inconsistencies and failures.

Mr. Lasker's solution to the thorny problem is the creation of international regional committees or organizations to study local conditions and recommend procedures. Separate committees would deal with particular problems. He believes that in this way the habit of co-operation may be initiated and grow. The suggestion is admittedly tentative in order to permit development as circumstances direct.

Mr. Lasker has written in the *Peoples of Southeast Asia* a discerning book of fundamental importance in grasping the problems of this region.

H. L. S.

NATURE PHOTOGRAPHY

Continued from page 239

lens; farther away, a No. 1 supplementary lens is needed—24 to 39 inches from the subject to the lens.

These auxiliary lenses change the focus of the lens in such a way that we can work closer than the three- or five-foot limitation built into all but ground-glass cameras. To make unusual pictures of small objects we have to move in closer than camera construction limitations permit. We soon find that these additional lenses are worth owning as soon as we see the results obtained with them.

The camera is placed at about the same height as the blossom. In the view finder or on the ground glass we compose our picture. But, hey, what is this? The front of the flower is facing almost 90° away from us, so we see only the side; that's not so good! Don't rush, that can be altered in a moment. We have other things to do first. Dried leaves and dead grass and twigs make a messy base to the flower and hide the stem. Very carefully we can clear away most of the debris, not disturbing the naturalness of the setting and leaving just enough to make the place appear as though this were a most orderly forest. Never scratch down deeply; this turns the spot into a backyard or park photograph. Now comes the delicate task of asking the flower to please turn this way and look into the camera. With care gently rotate or twist the plant stem in the direction of the camera. Do this several times, permitting the plant to return to rest after each twist. Success will soon come and the flower will face the lens and probably a bit skyward in the bargain. That can be corrected too. Lightly bend the flower stem near the blossom downward in much the same way that the optician bends the frames of glasses to fit over ears—between thumb and forefinger in a sort of sliding, coaxing motion. It is wisdom to practice on a few weeds in order to gain dexterity and not snap the head off the first flower we are planning to photograph. The reward of our cautious efforts will be a picture with beautiful cross-lighting on the blossom showing the depth of the corolla, outlining all edges and making transparent shadows be-

cause of reflections within the flower parts.

Suppose the wind were blowing. A bit of patience and we can easily see when to trip the shutter. If we watch the flower closely we discover that periodically the wind subsides for about one second, never longer on gusty days. Then is the time to expose. Over a fifteen-minute period it is possible to make six to ten exposures of a delicately balanced plant that quivers even when we turn the page of a book to find out what it is.

We want an interesting, story-telling picture. Along that line we can expand and make a second view encompassing the general location in which the flower grows. Another will show the woods from the field near-by. Interesting, too, would be an extreme close-up of just one blossom to go with the picture of the whole plant. Later in the season there will be the fruit to record as a finishing touch. In this manner we might have the life story of one flowering plant.

As we become more experienced, we discover that the soft, pastel-colored blossoms are the most difficult to record on Kodachrome. They require exact exposure and look best when they have a soft side light. Backgrounds are tremendously important and should be inspected before and not after the exposure is made. Supplementary lenses require no longer exposures than are normally used. They do create a bit of softness if the camera lens is not stopped down to f.11 or thereabouts. The depth of field is very slight compared with that of a normal lens, because we are working so close to our subject. Gauge the exposure for f.11 and stop down more if the illumination allows it. Almost any black and white panchromatic film is good, once its characteristics are understood, and that comes easily by doing. On the whole, we can get along without filters while photographing flowers.

Flower photography is relatively easy. First, find a perfect specimen. Select the view that will portray what is wanted in our result. Set up the equipment and make the exposure. That's about all there is to it, except for lots of patience and plenty of time. Don't forget that muddy feet and well soaked knees are sometimes part of a good time.

THE COVER THIS MONTH

Few animals in America have a wider range than the Red Fox. It is found throughout most of the United States and Canada and is one of the animals that is extending its range and probably increasing in number. The individual fox, however, confines his wanderings to a relatively small area, usually not more than five miles across, although under unusual stress of famine he will cover a larger area. The Red Fox does not care for the unbroken forest nor for densely populated sections, but is at home in the half-open country.

Resembling a small dog of slender build, the Red Fox has a long, bushy tail; long, soft fur; large, erect ears; and fairly long sharp claws. It is about 40 inches in length and weighs about 10 pounds. Both sexes

are reddish-yellow, grizzled with whitish. The back of the ears and the upper part of each foot and leg are black. The underparts are white. The tail is mixed with black but ends in a big white tip.

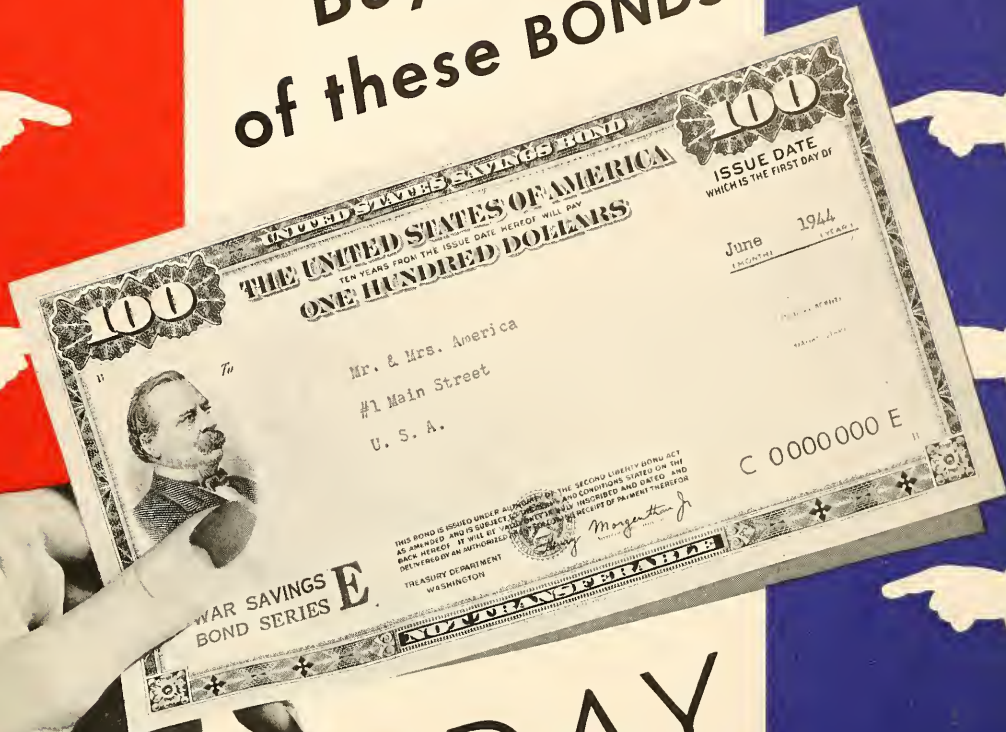
The fox is a predacious animal feeding upon birds, small mammals—especially mice—, and even fruit and berries. The fox usually hunts at dusk but has been seen abroad at all hours. He usually travels alone but may travel about with his mate when the snow is on the ground. The mating instinct is awakened in late winter, and the young are born in March or early April, four to nine in a litter. The cubs have fur but are blind until eight or nine days old and do not venture out of doors until they are about three or four weeks old.

The three-months-old fox pictured on the cover is a common Eastern Red Fox



(*Vulpes fulva* Desmarest) and was photographed in full color by Cleveland and Ruth Grant.

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June

NATURAL HISTORY

1944

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A popular guide to living mollusks and a valuable aid in identification of native and foreign shells. Numerous colored and black and white illustrations.

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A guide to the study of seaweeds and lower animal life found between tide marks.

WHAT SHELL IS THAT?

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A guide to the shell-bearing mollusks of Eastern North America. A foundation knowledge of the clams and snails of both salt and fresh waters and of the land snails as well.

FLORIDA SEA SHELLS

by Bertha D. E. Aldrich and
Ethel Snyder

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Description of shells, best beaches, history, cleaning, etc.

WHAT IS A MOLLUSK SHELL?

by Roy Waldo Miner

20¢

This 14-page pamphlet contains many interesting facts regarding these shells and is profusely illustrated with photographs of rare and unusual types.

➤ AMNH Photo

➤ *Chrysodomus decemcostatus* is found along our northeastern coast

➤ *Palynices heros* is common along the Atlantic Coast

The three drawings are from *THE SEA-BEACH AT EBB-TIDE*. By Augusta Foote Arnold

FOR THE SHELL COLLECTOR

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(Pink Conch) 9 to 10 inches

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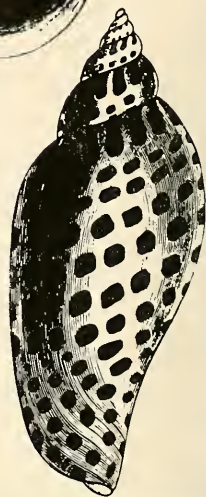
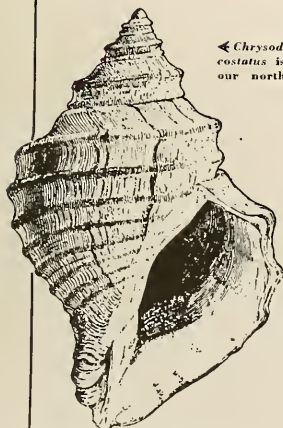
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The Soldier's Return

As our faith in victory is vindicated and confirmed by the daily march of events, the knowledge that nothing can last forever changes its meaning from one of consolation in despair to one of inspiration for constructive thoughts of the future. However long or short a time the war may still last, the need to plan for the peace to follow becomes more urgent every day. Whether the time of physical urgency has yet arrived is probably beyond any man's ability to predict. The fact remains that the psychological urge is already manifest and will not be denied.

We may welcome this urge, or we may consider it premature. But there can scarcely be any division of opinion about the desirability of guiding it toward the formulation of a successful plan, acceptable to the majority, instead of letting it spend its energies in futile minority efforts for lack of a general participation in the discussion. Regardless of our feelings about the timeliness of the debate it therefore becomes the duty of all of us to try to develop our thoughts on the subject and to contribute what we can to the general discussion.

It is a simple consequence of geography that our participation in any war fought overseas must expose our nation to a maldistribution of danger not experienced by any of our Allies on other continents. Our armed forces abroad are sharing in full the dangers of all with whom we have joined in the fight for civilization. But those of us who continue our work in a civilian existence must live in the shelter of a security which in itself becomes dangerous because it is so unequally shared with those we hold dear or most admire. Whether our place is at home or at the front, our concepts and our sense of values must change profoundly under the impact of war. Probably most of the changes will be for the better. But in accordance with the great difference in the experiences

by which they are created, our new personalities must differ also. A nation in which we had achieved a high degree of friendly understanding of one another is moving toward a reunion at which we shall be strangers again in our memories, our emotions, and our attitudes toward many things.

The difficulties will be great. They will be peculiarly our own, with little to guide us from the experience of other nations. Great readjustments will be required on all sides if the return to peace is also going to mean a return to happiness and progress. It is in the problems of the mental and emotional reunion of our nation that postwar education faces its greatest challenge, not in the mere professional or vocational training of the demobilized, which, by comparison, is a very simple undertaking.

The successful performance of this task does not depend upon the teaching profession alone but upon the understanding and co-operation of every member of the nation. We must all stop thinking of the coming peace simply as a return of the soldiers to our firesides and to the past and the pattern of life which we still represent. We must look upon it rather as a reunion in some unknown world, toward which we civilians also have a long way to travel. We must realize that if our reunion is going to be a happy one, we cannot ask our returning defenders to bear the entire burden of readjusting their personalities to ours, while we remain as we are in our thoughts and our emotions. Perhaps one of the main reasons for the "lost generation" after the last war was that feeling of loneliness which envelopes the partner in national or marital life who must carry the burden of adjustment alone. Great and generous efforts were made to fit the demobilized into civilian life again, and even greater plans for a similar purpose are being developed today. But we did not then, and we do not

now, give much thought to the necessity of also refitting ourselves and our pattern of civilian life to the new psychology of those who have fought for the security in which our own personalities have been molded. We are planning a great welcome, with every comfort and help we can offer. But we are making no plans to meet them half way and set up a new life in which we can all feel equally at home because it will bear the stamp of their personalities as much as the stamp of ours.

The problems of technical re-education and economic rehabilitation for the demobilized are of a purely practical character and therefore comparatively easily solved by sincere and intelligent effort. The needs can be measured and defined in concrete terms, and can be fulfilled by the application of already existing knowledge. The problem of achieving a happy and lasting readjustment between personalities grown apart as a result of the war is far more subtle and not capable of solution by reasoning from previous experience, since we have never made any real effort to solve such a problem before, even when the need to do so should have been obvious. Nor does the writer pretend to have found the answer. But no problem has ever been solved by attempting to disregard its existence for lack of an immediate answer. And if only a sufficient number of people in their own private thoughts will squarely face the difficulties which will soon confront us, that alone will take us a long way toward meeting the situation. And if our public discussions could be made to reflect our great concern about the manner in which we apparently neglect the most serious and difficult task facing the postwar education of young and adult, perhaps it might stimulate those capable of finding a practical solution into giving us an answer to the problem before it is too late.

A. G. Barr

*Director, The American Museum
of Natural History*

"I think I'd better stop now"

**When Long Distance Says—
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That's a good suggestion to follow. It means the lines to war-busy centers are crowded. It's a friendly, thoughtful act that helps the other fellow—and then some day turns right around and helps you.



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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ALBERT E. PARR, Director

VOLUME LIII—No. 6

★ ★ ★ ★ ★ ★

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YOUR NEW BOOKS

CONSERVATION • GEOLOGY • ATOMS

THE RUFFED GROUSE

No. 1, 1944

--- Edited by E. H. McClelland

Audubon Society of Western
Pennsylvania

THE Audubon Society of Western Pennsylvania has launched a new periodical under the editorship of E. H. McClelland and has chosen as the title of the journal the name of the state bird of Pennsylvania—The Ruffed Grouse. This initial number comprises forty-eight pages and six illustrations, and contains, besides a foreword and other editorial comment, ten contributions on various ornithological topics. Most of the papers concern the region of greatest interest to the members of the Society—Western Pennsylvania—but are of wider importance than this might imply. No clue is given as to the probable frequency of publication of this new journal, but the Society is to be congratulated on an interesting first number. J. T. ZIMMER.

CONSERVATION IN THE UNITED STATES

----- by Gustafson, Guise,
Hamilton, and Ries

Comstock Publishing Co., \$4.00

THIS is a slightly expanded second edition of a book that appeared in 1939 and attempts to cover the above immensely wide field. It is well illustrated and provided with many small maps and charts and gives some statistics.

Part I (Conservation of Soil and Water Resources) seems worthy of special commendation; also the chapters on fish and fisheries, grazing, and wildlife are all more or less satisfactorily dealt with.

But it is unfortunate that the new edition has not been more thoroughly revised and brought up to date, some statements being no longer correct; and on the whole there appears to be an unjustified degree of optimism and unquestioning approval of many policies and practices of government bureaus, which does not indicate the independence of thought and insistence on facts that such a book should have.

The very important subjects of forests, forestry, and the national forests and national parks are well dealt with in some respects but, unfortunately, with the inexcusable sordid and commercial view that the Forest Service has always held, that to allow a tree to stand after it can be profitably sold is criminal and that only the commercial interests have an equity in the forests that really belong equally to every man, woman, and child in the country.

Of course, the main purpose of the national forests is to procure lumber; but, if the reader has the book and will look at the beautiful stands of immense western white pines, Douglas fir, and Ponderosa and sugar pines pictured on pages 180-183, will he not be convinced that some stands of those wonderful trees, many centuries old, should be saved and not sacrificed for lumber while trees of ordinary size still exist? Should they not be the last to be cut, not the first as the Forest Service has been doing? Nearly all are gone already, probably the last of them will be before the war is over.

In spite of the book failing to take any stand against such vandalism, it has many good points and a wealth of useful conservation information.

WILLARD G. VAN NAME.

THE NAVAHO

Southwest Museum Leaflet No. 16.

----- by Francis E. Watkins

Los Angeles, 30¢

THIS is a welcome addition to popular publications for museum visitors and others interested in the Southwest. Under the name Navaho is comprehended a number of tribal groups of our most picturesque Indians, numbering about 50,000 and increasing much faster than any other population group in the United States. The text is easy reading, but very compact, giving the essential facts about the home life, arts, crafts, history and present state of these Indians. Their original language is Navaho, and their schools are now provided with text books printed in the same. Every one interested in Navaho textiles and silver work should own a copy of this little book.

C. W.

GEOLOGY FOR EVERYMAN

----- by Sir Albert Seward

Cambridge, at the University Press;
New York, The Macmillan Company, \$3.25

THE English seem to have a special ability to produce outstanding works in popular science, particularly in the geo-

logical sciences. Many of these have been written by men who are leaders in their sciences; the present book merits inclusion high on the list of the best of such works. Sir Albert Seward was one of the world's most eminent paleobotanists and served for 30 years as a professor in the University of Cambridge.

In this volume, completed but three days before his sudden passing, he has injected the cumulated delight of a lifetime of geologic investigation in an expressed desire to show others the way to the same satisfying enthusiasm. Interwoven into an account of the geological history of England and Scotland is a broad foundation in the principles of the geological sciences. While the fact that the geologic illustrations are thus drawn from the English scene may detract somewhat from the value of the book to the non-English reader, nevertheless the lucid explanations of geologic phenomena give the work universal value, and the author's felicity in the use of the written language imparts to it a high literary quality.

No comparable popular treatise in its field has been produced by an American author; our scientific literature will be greatly enriched when such a work does appear.

H. E. VOKES.

EXPLORING WE WOULD GO

----- by Ellen Gatti

Charles Scribner's Sons, \$3.00

WHEN "Tillo" Gatti captured Ellen and carried her off to the eastern Congo, he planned to bring back a couple of okapis to the London Zoo. Ellen was frankly terrified by the thought of the jungle. How her fears were dissipated, how a home was set up in the shade of the forest, and how she finally became Mrs. Gatti, despite the red tape of Rome, Riga, and Kampala, these form the body of the book. The transition from an ultra-modern executive secretary to the co-leader of a jungle honeymoon in Africa was achieved with undeniable aptitude and enjoyment.

The recital of her experiences shows but little acquaintance with exploration. To be sure, Commander Gatti spent considerable time in the forest with the Pygmies, hunting okapis and bongo; and he did secure one fine bongo for the Zoo at Rome. The nervous okapi proved so difficult to handle that none reached Europe. To claim that nothing still was known about such a celebrated animal is little short of presumptuous.

There was of course plenty to be studied and scientifically explored right around Tzamboho. But Ellen's approach is emotional. She is filled with admiration for

Continued on page 286

NATURE LOVERS' LIBRARY

Six Giant volumes, 8 1/2 x 11 1/2, 2,000 pages, weight 23 pounds. Lives and habits of 3,000 species of birds, mammals, reptiles and fishes described by world famous Naturalists; 1,000 species illustrated, 300 in natural colors; published at \$29.50. The Literary Mart, 411 West 125th St., New York, offers this set to members for \$19.50, returnable for full refund after 5 days' examination. Nature Encyclopedia edited by G. C. Fisher, 5 volumes with 200 colored illustrations, given free on orders mailed in June.



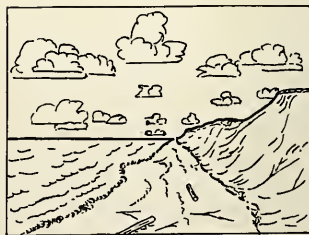
Greener Fie

By THANE L. BIERWERT

*Acting Chief, Division of Photography,
American Museum of Natural History.*

IF you want to spend a photographic holiday, you can learn more about good pictures by living on one square mile for two weeks than by taking a Cook's Tour for one month. Such a vacation gives you the unusual opportunity of watching your surroundings change under varying conditions. Thus, you are able to study the subjects and make your exposures when the illumination is most favorable, rather than under circumstances of "now or never." You can learn to analyze picture possibilities by experimenting in the selection of viewpoints for pictorial composition. Later, after you make prints, you can conduct a survey among your friends to determine which are the best results, and pattern your future picture-taking on that experience.

Suppose you are to spend your sojourn in the mountains—what are a few of the picture possibilities? All about you is the scenery, beautiful to look at: rolling mountains, fields and meadows, farmhouses, and vacation sky. The problem is how to put it together and have it look good. You could go up onto a high hill and point the camera to the horizon and shoot the 360°. It would look good to you, but what would it mean to others? Why not look around and use some of the knowledge you have picked up from reading magazines and books, visiting photographic salons, and from lectures. Look for some foreground interest, leading lines, and for a focal point of interest for the composition. A farmhouse or small



▲ "LEADING LINES"

village with a roadway leading to it from the side of the picture area can be framed by a tree in the immediate foreground. To make a better picture, the latter should be balanced by another tree across the road. This is an improvement over having a center of interest set among rolling hills under a cloudless sky.

Another photographic subject might be fishermen at their sport, in lake or stream. Get out on the lake with them some morning before the sun is up and before the mist and fog are burned off. Kodachrome fans can make some unusual slides cov-

incisors, one on each side, not found in deer. It must have been the number of the upper incisors in adult camels that inspired this comparison, ignoring the structure of these and the other 32 teeth.

The feet of a camel are very unlike those of the elephant. Camels walk on the toes, which are two in number on each foot. Under the toes there is a well-developed foot pad, and the basal bones of the toes are solidly fused together. An elephant has five toes, each quite separate, and they partly enclose a large cushion of fatty connective tissue which bears most of the weight. The elephant's feet are short, those of the camel very long.

The camel has a long neck, but this neck is no more swanlike than it is turtle-like or dinosaur-like. Its neck has only the normal seven vertebrae of mammals, and these are much like the neckbones of a deer, only longer. The neck of a swan is many-jointed, and the bones very different in structure.

Camel blood is unique among mammals in having oval red corpuscles instead of round ones. The corpuscles of birds, reptiles, and amphibians are also oval, but their corpuscles are nucleated, while those of camels, like other mammals, have no nucleus.

Camels are warm-blooded animals. Although their heat control is less perfect than ours, they do not have the temperature of a snake. Snakes, like other reptiles, vary in temperature according to the temperature of the air around them. When the weather is hot they become warm, when it is cold they become almost as cold.

A camel can see through partly closed eye-lids and can distinguish between light and darkness with the eyes closed, but so can we.

Any animal when parched with thirst may behave strangely if given too much water suddenly. A camel may even die under these circumstances, but this condition is not drunkenness in the common understanding of the expression.

One authority here in the Museum remarked that it would be difficult to get further from the truth in the same number of words.

J. E. HILL,
*Assistant Curator, Recent Mammals,
American Museum of Natural History.*

SIRS:

I was very much pleased with your article "The Modern Nature-Faker" in the April number.

This recalls an animal exhibit at our county fair, several years ago. There was shown an animal with a placard on the cage, stating that it was a cross between a rabbit and a ground hog, and that it had been captured on Mr. Clay's farm just six miles from town.

The fake was exposed by a gentleman visitor who had made a trip to South America and identified it as an agouti.

Two weeks later it was shown at another county fair, 30 miles away, but the placard read that it had been captured eight miles from that town.

More articles of this nature would clear a lot of these fake stories.

H. O. BROWN.
New Springfield, Ohio.

SIRS:

I enclose a "nature" article from today's paper, because it appears to be a case like those mentioned in "The Modern Nature-Faker."

BIRDS HAVE DEATH PENALTY
FOR CRIME

"You may be a lover of birds, yet you may not know that they have very rigid laws relating to bird behavior, and actually settle their cases by jury trial.

"It is related that once a sparrow appropriated a nest belonging to a martin. When the martin returned and discovered the theft, it flew away without apparent protest. But soon it returned, accompanied by several others. What amounted to a session of court was held, but the sparrow was obdurate and seemed to have won the case. In a few hours a host of martins arrived, each carrying in its bill the earth material used by martins in making their nests. Surrounding the swallow thief [the sparrow, we assume!], each dropped its measure of earth, literally burying the culprit alive.

"Again: A bird fancier visiting in Turkey wanted to secure a stork, dead or alive. He dare not snare one, as the Turks have a holy thought regarding the bird. But knowing the habit of birds to penalize misconduct, he removed three eggs from a stork's nest and placed hens' eggs in their place. When the chickens were hatched there was a great ado. 'Father Stork' flew away, only to return with his court of justice. There was a spirited trial, and although the mother stork apparently pleaded her innocence, she was found guilty of misconduct and was killed.

"Occasionally there is acquittal—sometimes probation, but the usual penalty for breaking bird law is death."

I should be interested to know whether these cases might be true.

MRS. PAUL I. WREN.

Medford Hillside, Mass.

It can be said on good authority that these stories are not true.—Ed.

* * *

SIRS:

Mr. Carr, in his entertaining article, "The Modern Nature-Faker" (April), intimates that certain types of misinformation are deep-rooted and have persisted through the ages. Very likely scholars will find something about ostriches burying their heads in the sand in Babylonian clay tablets.

The tale he quotes about a dolphin bearing a child across many miles of water to safety was an ancient legend even to Herodotus. He tells it not about a two-year-old child but about Arion the harpist who had hired sailors to take him from Tarentum home to Corinth. The greedy sailors wanted to do away with him and pocket his riches; Arion jumped overboard and "a dolphin took him on his back" and conveyed him to Corinth where, to their dismay, the mariners found him. He arrived first, of course, for sails and oars cannot match dolphin speed—as every Sunday-editor knows.

New York, N. Y.

B. W. HUEBSCH.

Pliny also gives some similar stories about the dolphin.—Ed.

PHOTOGRAPHY

ds Are Near

ering the changes of atmosphere over a period of half an hour. You'll find that the haze imparts to your pictures, whether in color or black and white, a soft quality superior to the unobstructed rays of a hot sun shining on your fishermen in their rowboat. Of course, you realize that you are never to sit with them unless you intend to fish. (To be in the same boat and only make pictures—don't test the fisherman's proverbial patience that far.) Along the stream, you'll need sunlight to show the thrill of wading through the rapids and casting over the still, deep pools.

If you know where to look, there are always the small flowering plants and small animals to photograph. Close-ups of frogs, salamanders, insects, birds, and small mammals are interesting. If you are near a farm, photograph some of the chores, haying, milking and feeding, or try a hand at some studies of harness on the wall, weather-beaten sheds, vine-covered stone walls, and fences or farm tools. If you keep your eyes open and are out for some real fun, you can bring home more good pictures than any 3,000 mile trip "on the run" ever gave you.

Should you go to the shore, you'll find a different sort of picture series. The scenery will be the beach, sand dunes, and the surf, all of about the same intensity of color and brilliance. They require correct exposure to give quality in your negative. Careful study will show you that shadows really make seashore pictures, by breaking up the smooth expanses into interesting patterns of wind ripples or grass swirls. Include a fence for leading lines, some surfcasters or bathers on the beach for human interest, and perhaps a lighthouse for your center of interest.



▲ A YOUNG NATURALIST examining his find: an example of the candid camera vacation record that is cherished in years to come



▲ THE BARE FOREGROUND in the photograph above has been replaced by objects adding foreground interest in the picture below. Note that the background hills are almost exactly the same size in both views

▲ POOR COMPOSITION

▼ GOOD COMPOSITION



The children at play in the sand offer opportunities for candid action shots to cherish in years to come. A beach picnic is excellent to record, too. If you don't mind being buffeted around, you could try a series of pictures of surfcasting. Along the tide lines will be found the cast-up jellyfish, horseshoe crabs, seaweeds, shells, egg sacs, piles of foam and drift wood. They are all interesting studies.

Beware of two ever-present enemies at the sea shore: (1) salt air moisture to corrode metal and rot leather, and (2) sand to get into moving parts and scratch and "jam the works." The best precautionary measures are to keep your equipment dry and clean. Wipe everything after it has been exposed for any length of time. If you let things go, you may have a repair bill on your hands.

Before you go on a vacation, it's a good idea to look over your camera equipment to see that it is in order. There is nothing more disconcerting than having pictures all around you and then discovering that the diaphragm leaves have stuck or that the take-up spool slips. Check the shutter, diaphragm, range finder, and focus; blow out the dust and try a roll of film in case you haven't used the camera since last

summer. If you own an exposure meter and use color film, check your meter readings carefully with your results and see that the meter reads correctly. It is difficult to use an exposure guide under extreme light conditions (forest shade or beach glare). Many exposure meters operate satisfactorily over the middle region of the scale but are out of register above or below it. Remember that expensive equipment deserves protection; bring your cases along. In order to travel light you might find it necessary to leave your tripod at home. Ninety-five per cent of your exposures can be made satisfactorily without a tripod. However, there are some subjects, especially close-ups, that cannot be photographed by hand-held cameras—so borrow if you must. A solid support for your camera frequently pays dividends in sharper negatives and bigger enlargements.

Filters are wonderful in recording those vacation-day clouds. Bring at least two, a light or dark yellow and a light red. If you are the proud possessor of a Polaroid, by all means take it along. This filter is good for both black and white and color films. Without distorting color quality, it darkens skies and brings clouds

Continued on page 288

Nature's greatest BONEHEAD was a Dinosaur



A.M.N.H. photo

▲ AS HE APPEARED in life: a restoration of the prehistoric animal whose scientific name appropriately means "the thick-headed reptile" (*Pachycephalosaurus*). Note the dome of solid bone and the bumps and knobs

► THIS 20-foot monster had a brain so small you could hold it in the hollow of your hand. Yet the family survived through many millions of years

Drawing by John C. Germann

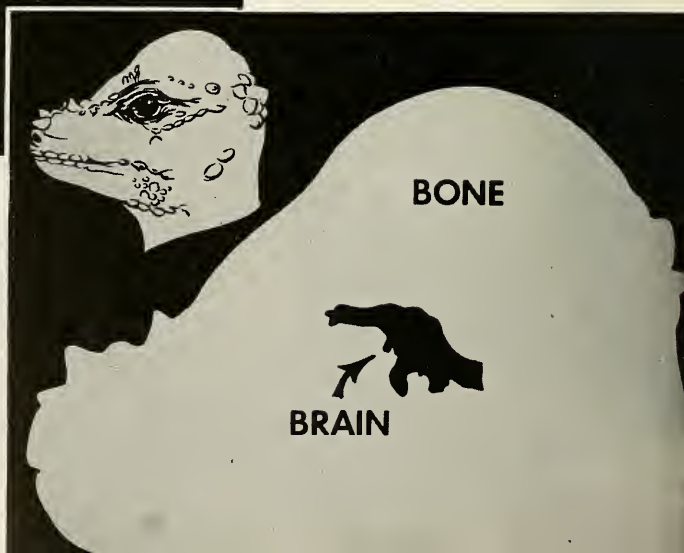
By EDWIN H. COLBERT*

Chairman, Curator of Fossil Amphibians
and Reptiles,
The American Museum of Natural History

IT is not easy to surprise a paleontologist. He spends his time studying the record of evolution, looking back over the history of life as it has evolved on earth through millions and hundreds of millions of years. He sees that during vast stretches of geologic time many lines of animals have appeared, developed, and become extinct. He sees that through the long periods of earth history there has been ample opportunity for unusual animals to evolve—animals that have developed in bizarre ways and along lines that may at times seem to be inexplicable.

The paleontologist, in his study of the past life of the earth, has become familiar with these many lines of animal development, so they do not seem strange to him. Through long and close association they have become familiar. That is why it is difficult to surprise him; he is accustomed to the "unusual" and the "bizarre."

Which, if one stops to think it over, is just what might be expected. Things are to us unusual mainly because they are unfamiliar. Animals that seem commonplace to our way of thinking, might to a man of the future appear to be very strange indeed. We speak of the dinosaur as strange, but look at the turtle—a highly specialized and most "unusual" animal to which we hardly give a second thought. We exclaim over the outlandish appearance of the giant ground sloth, yet to some of our forerunners in North America—the Asiatic men who first reached



this continent some twenty thousand years ago—the giant sloth was a common and accepted sight. It is safe to say that if these early men had ever had the privilege of seeing our familiar friend, the giraffe, they would probably have been dumbfounded.

Nevertheless, in spite of the scientist's familiarity with the unfamiliar, there are times when even he is rather perplexed by some new discovery. There are times when he is really puzzled by a fossil that reveals an animal hitherto unknown, an animal that has developed along quite unexpected lines.

The history of the dinosaurs is a long and varied one, marked by many lines of evolutionary radiation. A hundred years of careful study have revealed that there were large dinosaurs and small ones, meat-eating and plant-eating ones, quick, agile dinosaurs and slow, ponderous dinosaurs, upland and swamp-living dinosaurs, duck-billed dinosaurs and horned dinosaurs, and so on through many other categories of dinosaurian developments and characteristics.

But within the past few years we have learned about a new and different branch on the dinosaurian tree, a branch that until recently had been a good deal of a puzzle because of our lack of information concerning it. This may be called the "bone-headed" branch—a term that is given in all seriousness as a descriptive, not a derogatory appellation.

Our knowledge of these dinosaurs, which are more properly designated as the *troodont* (trō-o-dont) dinosaurs, dates from the year 1856, when the great founder of vertebrate paleontology in North America, Joseph Leidy, described a single tooth that had been discovered in the badlands along the Judith River of Montana. This animal was named *Troodon* (tro-

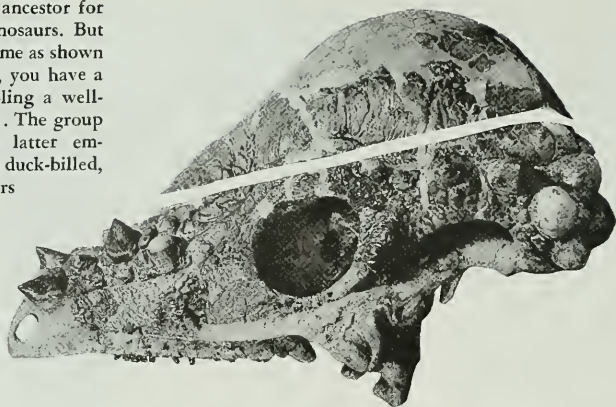
*EDWIN H. COLBERT, whose particular interest is in the evolutionary history of backboneed animals, has been associated with the American Museum of Natural History since 1930. During that time he has published various scientific contributions on the prehistoric animal life of North America, India, Burma, and Mongolia. At present he is working on some of the early reptiles that lived at the beginning of the Age of Dinosaurs. He has been on a number of expeditions to the fossil fields of western North America and has spent some time studying in European museums. Readers will recall many previous articles by him, on subjects ranging from mammoths, saber-toothed tigers, and other creatures of the past to such familiar animals as giraffes, pandas, and dogs.—Ed.

For sheer thickness of skull and relative smallness of brain, this 20-foot prehistoric creature even astonished the men whose business is the wonders of the past



AN EARLIER RELATIVE (*Troodon*) of the dinosaur at left; an animal only about six feet long but already showing the promise of a bonehead to brag about

ON FIRST GLANCE one might be at a loss to find an ancestor for the bone-headed dinosaurs. But if you remove the dome as shown by the dividing line, you have a skull closely resembling a well-known type (below). The group represented by the latter embraced the armored, duck-billed, and horned dinosaurs



A.M.N.H. photo; drawing by John C. Germann

o-don) by Leidy, from the Greek, *troo*—to wound, and *odon*—tooth, because he supposed that the fossil he saw was a cutting tooth, possibly from some sort of a lizard. Naturally it is somewhat difficult to predict the appearance of a new and entirely unknown animal from a single tooth, and Leidy made an understandable error in trying to guess at the characteristics of the reptile of which he had such a small and insufficient part.

For many years our knowledge of *Troodon* was based upon this tooth. Indeed, one might say that *Troodon* was a tooth, not an animal.

Then, in 1924, Mr. Charles W. Gilmore of the United States National Museum unlocked the secret of *Troodon*, through his description of a skull and part of a skeleton that had been found some years previously by Mr. George Sternberg along the Red Deer River of Alberta. This specimen is now in the University of Alberta.

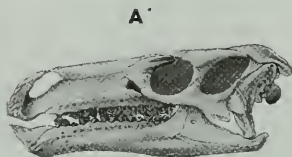
Troodon turned out to be quite an unexpected type of dinosaur. In the first place it was rather small, being no more than six feet in length and standing some two or three feet in height. Moreover, it was a bipedal dinosaur

—that is, it walked on its hind legs, which were long and birdlike, while the fore limbs were reduced. Thus the body was pivoted on the hips, and the weight of the body itself was counterbalanced by a long, flexible tail. But

the most surprising feature of *Troodon* was the skull, for it was characterized by an unusual, one might say a remarkable thickening of the skull bones above the brain case. Consequently the top of the skull took the

FROM FORERUNNER TO FINAL FORM: showing that the bone dome had developed greatly before the general increase in size had come

- (A) *Camptosaurus*;
- (B) *Troodon*;
- (C) *Pachycephalosaurus*

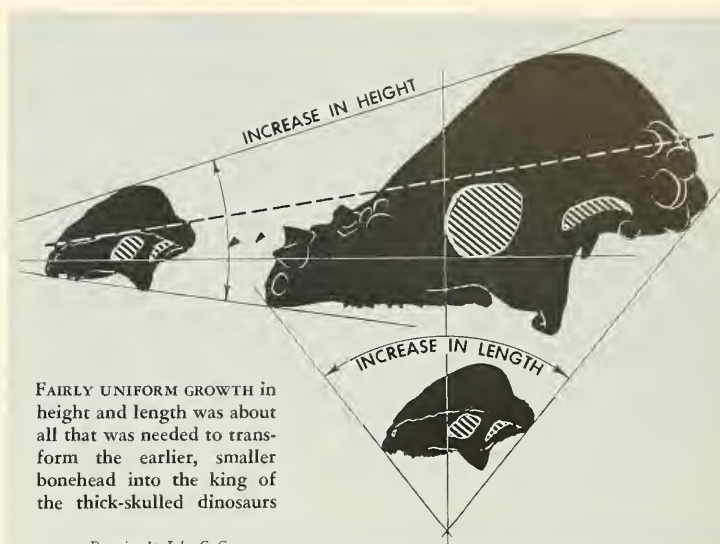


form of a rounded dome, arching high above the eyes. This was a solid dome, a dome formed of rather dense bone, from the brain itself out to the surface of the skull; hence the reason for calling *Troodon* a bone-headed dinosaur. The jaws were armed with teeth of exactly the same type as the single tooth described by Joseph Leidy so many years before.

Such was *Troodon*—truly a surprise package for the paleontologist.

We now skip over a period of sixteen years to the year 1940. During the summer of that year the late Dr. Walter Granger, accompanied by Mr. Albert Thomson, spent some time in the interests of the American Museum of Natural History collecting in South Dakota and adjacent states. In the course of their travels they went to Ekalaka, Montana, to call upon a friend of this Museum, Mr. Walter Peck. They saw Mr. Peck, and they also saw a treasure that Mr. Peck had to show them. It was the skull of a troodont dinosaur, but a troodont considerably different from *Troodon* itself. It was a greatly enlarged troodont, a dinosaur of truly noble proportions.

This fine skull, which had been found and collected by Mr. William Winkley and Mr. Peck near Ekalaka, was housed in the Museum of the Carter County Geological Society, a very active organization of local people interested in things geological. Mr. Peck, a prominent member of the Society, realized that he had a treasure, and he also recognized the fact



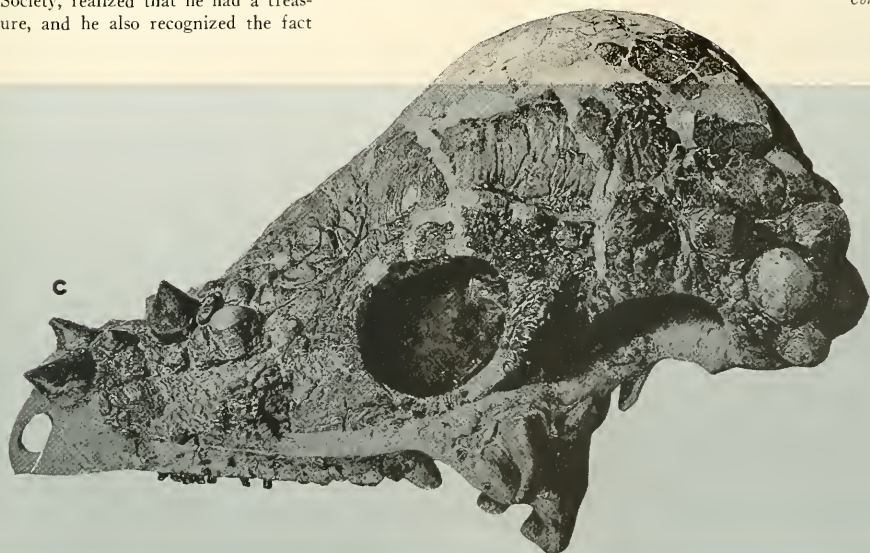
that the proper preparation and study of this fine specimen was beyond the facilities of the local Museum. So, with a fine spirit of scientific co-operation, he made arrangements for the fossil to be presented by the Carter County Geological Society to the American Museum of Natural History.

It was a big job, getting this skull cleaned up and studied, but it was a job well worth doing. Finds such as

this do not come along every day in the week. The work of cleaning and restoring the specimen was tackled with enthusiasm by Mr. Otto Falkenbach, and in due course of time his skill as a preparator enabled the specimen to be put in shape for study and exhibition. It was then studied and described by Drs. Barnum Brown and Erich M. Schlaikjer of the Museum's scientific staff.

This new fossil was named *Pachy-*

Continued on page 284





Afoot across the Olympic

THE OLYMPIC MOUNTAINS, in Washington State's northwestern corner, were discovered by white men 170 years ago, when the roving Spanish sea captain Juan Perez sighted them as he sailed along the Pacific Coast. Rising from a dense cloak of forest, these mountains present some of the finest Alpine scenery to be found in the United States. Yet after all these years, and although no point in the Olympic Mountains is more than 50 miles from the sea, there are many places among their jagged peaks never visited by man.

The subject of this article is a trip directly across the highlands of Olympic National Park. This was performed by Mr. Hugh Brooks in company with Mr. Herbert Crisler, whose energetic and protracted excursions into the mountains have earned him

✓1 THE CAMPERS drove from Port Angeles to Olympic Hot Springs for the first night. From there a "hairpin" trail led them up the slopes and along Hurricane Ridge shown below. Mr. Crisler's fiancée, who has since become his wife, accompanied them the first day, then drove to the other side of the Park to meet them



the title "Tarzan of the Olympics" among his friends.

This is a wilderness empire of rugged peaks, alpine meadows, riotous wild flowers, canyons, glacial lakes, and rushing waters. More than 20 of the wild flowers seen in Olympic National Park are not found elsewhere, and there are more than 36 square miles of ice and snow fields. The glaciers are said to be slowly receding.

These glaciers are, of course, fed by the heavy winter snowfall on the higher slopes of the mountains. The rainfall in summer is less than that in the Eastern United States, but the winter precipitation on the western slopes amounts to 12 feet! As a result, vast forests of large trees, which reach a maximum diameter of over 17 feet, thrive in the deep valleys, presenting an almost junglelike appearance. Mosses drape the trunks and the branches and help to carpet the fern-clad ground.

More than half a dozen roads extend a short distance into this wilderness. Beyond, numerous trails lead the camper or hiker into choicer, wilder areas. But most of these photographs along Mr. Brooks's route were taken where no trails link the traveler with the world behind.

Wilderness

By HUGH BROOKS



2 A VIEW high above Olympic Hot Springs showing a flower-covered ridge that led toward the higher peaks and ridges. Complete provisions for the trip had to be carried on the back, and "Tarzan of the Olympics" packed about 80 pounds

3 A short distance beyond, the route descended into Cat Creek Basin, where this beautiful little lake was skirted. Not far from here the party made its second camp



4 HERBERT B. CRISLER photographing the flower of the yellow arnica against the deep blue of the mountain sky

5 "SILVER FOREST" is an appropriate name for the weather-bleached trunks of these trees on Cat Creek Ridge, rising from a lively bed of bear grass



6 SPECTACULAR and abundant over large areas, bear grass blossoms are cream white at the top and greenish toward the bottom



7 AVALANCHE LILIES photographed on Hurricane Ridge



8 NEAR THE END of the foot trail. Beyond, a cliff drops in the direction of the distant snow-covered ridge, which Mr. Brooks and Mr. Crisler traversed from left to right



9 A BEAUTIFUL TIGER LILY photographed in the alpine meadows. Heavy snows protect the plants in winter and provide abundant moisture under the warm summer sunshine



10 A LEAN-TO previously built by Mr. Crisler provided ready-made overnight accommodations at Cream Lake. A pair of elk antlers have been erected near where he stands. Roosevelt elk number over 3000 in the Park



11 CREAM LAKE, viewed from near the camp at left. Eighty or 90 elk were seen on a grassy flat not far away. Black-tailed deer, black bear, mountain goats, and cougar can also be observed, as well as whistling marmots and ptarmigan



12 A SPACIOUS view across Hoh Valley toward Glacier Creek Valley and Mt. Olympus. Rising from near sea level, the Olympics are more impressive than most mountains their size



13 A GREAT NUMBER of small, clear lakes like this one in the Bailey Range dot the high glacier-carved slopes and provide pleasing vistas toward Olympus and other peaks



- ▼14 A HIGH POINT on the Bailey Range was the camp site shown below: a wild scene looking westward toward the mountains behind which the sun has just set in a cloudless sky



- ▼15 THE CLIMBERS crossed the high snow field seen in the distance below and reached the ridge to the right of the prominent peak in the center of the photograph



- ▼16 MOUNT CARRIE, 7020 feet high, as seen from Car Creek Ridge. Streams on the southern slopes of Mt. Carrie flow into the Pacific, those on the north lead to the Strait of Juan de Fuca



- ▼17 ON BROAD EXPANSES of snow like the one below, dark glasses were needed to protect the eyes from the brilliant glare. Extraordinarily fine weather accompanied the travelers throughout their 7-day trip



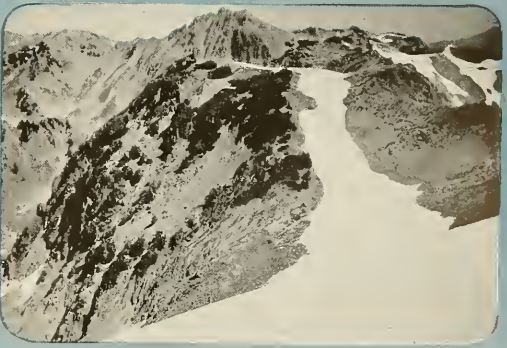
- ▼18 APPROACHING an altitude of 7000 feet, Mr. Crisler in the lead faces the ridge that is seen from a distance at lower left. The route lay along the high ridge to the right



- ▼19 THAWING at midday makes some of the snow slopes in the Bailey Range treacherous. But a cautious choice of the proper route ensures a safe approach to some of the finest vantage points for the camera man who seeks to photograph the mountain scenery



- ▼20 A VERITABLE FIFTH AVENUE of snow made progress easy along the ridge below. Elsewhere steep slopes like the one descending to the left were more tedious to travel, particularly around the southwest flank of Mt. Carrie, a peak in the Bailey Range





▲ 21 ICY "HIDDEN LAKE" at the head of Queets Basin. Incredibly clear, deep-blue water reflected the sky and imparted delicate green tints to the submerged ice

▲ 22 SUCCESSIVE SNOWS of previous seasons are recorded in this hard-packed cap along which the route lay. The slope at right descended some 6000 feet

▲ 23 A "SNOW FINGER" at the headwaters of the Elwha River. This becomes one of the main streams flowing northward from the heart of the Olympic area



▲ 27 BENEATH A MIGHTY ARCH of ice, one feels the struggle that is taking place between winter and summer. Jumbled fragments of another arch, recently fallen, are seen in the foreground

◀ 28 THE CHALET at Low Divide: a stopping place on the route to Mt. Olympus from the south. The forest rangers had not yet arrived for the summer season



▲ 24 MR. HUGH BROOKS examines a circular recess in the "snow finger" shown at left and the noisy little cascade that helped to form it



▲ 25 FROM A TURQUOISE-COLORED ICE CAVE dash the rushing waters that tell the speedy approach of summer under the hot sun of early July



▲ 26 AN "OLD-TIMER" in the Bailey Range. Notice the thick growth at the foot of the clumps in the background. A scene near the tree line



▲ 29 MORE DIFFICULT than any mountain climbing encountered by the men during their trip was an area of fallen timber near the southern end of the journey. A violent storm had leveled the trees, and in places it was necessary to climb among trunks and branches 20 or 30 feet above the ground. Five hours were consumed in covering a distance of only two miles

➤ 30 AS CIVILIZATION is approached, the north fork of the Quinault widens and ultimately flows along the southern boundary of the Park. The range in scenery offered by a traverse of the Olympic area runs the gamut from high alpine crags to dense evergreen forests and tree-girt streams that reward the fisherman



Three years ago Truman Bailey came back from a long journey to the Pacific Islands and Eastern Asia. He was rounding out an exceedingly novel undertaking, and like many a traveler from afar, he came to the American Museum.

He had been studying the native arts of various tribes. Everywhere he went, the natives seemed to be trying to make a short-cut to civilization. They were forgetting their authentic artistic heritage, losing their cultural identity, and gaining scant economic security in the process.

The making of white lacquer in China was a lost art, forgotten for two centuries. With the aid of local artisans Truman Bailey was able to rediscover the method and raise it once more to a commercially practical art. Wood-carving in Polynesia and pottery-making in the Far East likewise responded to the direction of this visitor from the West, who not only could recognize the best in art but could talk in terms of its potential value to the rest of the world. One by one, primitive communities that were falling before the machine age began to recapture their cultural individuality.

Civilization destroys many things. Wise conservation is its necessary partner. Mr. Bailey's conservation effort is unique in that it aims not toward the preservation of wildlife or natural resources but towards the saving of native peoples and their culture.

On the basis of his experience it was no wonder that the Inter-American Development Commission appointed him to direct a survey of native arts in South America, and that the Peruvian Government made him technical Advisor *ad honorem* of the Dirección de Industrias.

Readers may recall Mr. Bailey's previous articles on Samoa, the ruins of Angkor, and trained elephants of the teak forests. The present article tells the first chapter in his survey of native Peruvian arts and their possible bearing on the lives of North Americans. His unique pilgrimage, described here for the first time, took him all the way from museums and libraries to native huts. And because he went not to talk about his own country but to learn about his neighbor's, he has much to tell.—ED.

Building upon her rich cultural traditions, Peru, with the co-operation of the United States, plans a new place in the world of art and industry for her native people

By TRUMAN BAILEY

Photographs by the author from Three Lions unless otherwise credited

VARIOUS Latin-American countries have invited the collaboration of the United States in problems of social, educational, and economic development. Students versed in Latin-American relations realize that these requests are highly complimentary. They reflect a remarkable progress made in a comparatively few years toward an understanding of mutual problems.

Both Peru and the United States will benefit from the work described on these pages. Peru will develop arts and crafts to provide profitable vocations for many natives. And for the United States, developments like this alone can create the post-war market that is vital to our expanded manufacturing economy. It is interesting to many that "museum sciences" have played an essential part in a program which, aside from having strong cultural value, will establish such a welcome economic relationship.

This is a pioneer project. I was the first to go into the field on this type of work for the Inter-American Development Commission. My work and my observations in this connection are limited to Peru.

Before I left Washington in November of 1942 to undertake these studies, many hours were devoted to

preliminary research and the formulation of plans. The program was divided into phases, which, although overlapping, set up definite requirements for each part. The first was one of study, covering a period of nine months. Later a practical demonstration would be required. Finally the work would be organized on a commercial footing. When this was accomplished the United States Government would step out of the picture.

Although experienced in the field of Latin-American handicrafts, I was privileged to have the benefit of expert counsel. My preliminary objectives and the scope of the project became very clear in the course of these meetings and consultations. I was to study the manual industries of Peru as potential factors in the development of her natural resources in raw materials, craft tradition, and manual skill; make a pictorial record for study purposes; collect samples of contemporary materials; carry on preliminary experiments in styling; and prepare concrete suggestions for the development of manual industries.

In times past a trip to Peru was something with which to conjure. Modern air transportation has made it as commonplace as a trip by Pull-

man from New York to St. Louis, only faster. But even the speed of travel cannot eliminate the wonder of leaving the United States on a cold winter's morning and arriving in Peru the following afternoon in summer. Nor can the beauty of the thundering flight over varicolored seas, emerald jungles, and jagged snow-capped mountain peaks 20,000 feet high be overestimated.

The fact of being in Peru after months of preparation filled me with so much desire to get started that I had to take a tight grip on myself to do the methodical preparations necessary to my task.

I first obtained residence in a private home with Peruvian friends whom I had met during a previous trip in 1939. To be taken in by a Peruvian family is a rare privilege, and I was to enjoy through them the benefit of expert advice in interpreting their country, assistance with my experiments, and an opportunity to learn a new language under ideal conditions. The facilities they extended to me even included a small workshop-laboratory. I made my contacts with my own Embassy and with the Peruvian Government and finally, filled with eagerness, I was ready to take up the challenge of my work.



Native Arts Shape the Native Future

► THE NATIVE OF PERU looks out from a background rich in artistic and cultural tradition into a strange new world of tomorrow

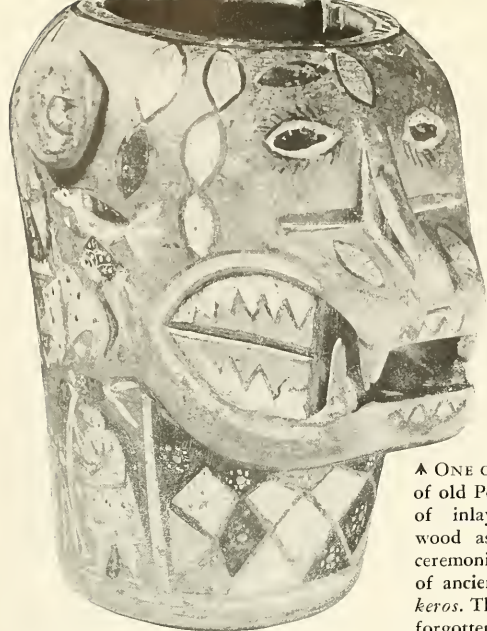


▲ CENTURIES AGO the ancestors of the present-day Indians built a civilization which the world admires and which still influences the lives of the people



▲ MASTERS OF DESIGN in stone, wood, metal, and cloth, the ancient Peruvians bequeathed to Peru a heritage of rare worth

NATIVE ARTS SHAPE THE NATIVE FUTURE



A.M.N.H. photo

▲ ONE OF THE "LOST ARTS" of old Peru is the technique of inlaying lacquer into wood as exhibited in the ceremonial drinking vessels of ancient origin known as *keros*. The world has all but forgotten the technique yet can use it today

It is curious how a legend is allowed to grow around ancient methods, which ends in their being identified as lost. Usually it is simply that no one has had the curiosity or time to investigate the process with close attention to the original factors.

Soon after I arrived in Peru I was intrigued by the technique of the decorative designs on ancient Peruvian drinking vessels called *keros*. The museum official who was my guide confessed that he had never investigated the method but referred me to an article by a famous archaeologist. This gave me certain clues but was far from exhaustive.

I persisted in my quest all over southern Peru, where the *keros* originated. Ultimately I obtained samples of this beautiful technique of inlaying "lacquer" into wood. Finally, after a score or more attempts, I arrived at a satisfactory duplication of the process, even to the original pigments used.

This process presents magnificent possibilities in functional decorative art. All of the necessary ingredients are abundantly available, including the skilled carvers. At a future time I shall describe the process in detail.

ANCIENT PERUVIAN TEXTILES exhibit every type of weave known to the modern world and some that are not. The finest of the fabrics have 270 threads to the inch—a higher count than any other weavings that use wool in the weft



▲ SHEEP THRIVE in Peru today. Much of the stock, like this, is not good. Almost all of the good wool is exported beyond easy reach of the native weaver



▲ WHEN WOOL is needed for weaving, the native usually kills the sheep, skins it, washes it on the hide, and clips the wool in a primitive fashion. If a sheep cannot be spared for the work, the weaver cannot make his wearing apparel. The quality of the wool is at best not equal to the creative talents of the native craftsman

WITH the artistry of true craftsmen, the Peruvian Indians even decorated the small wooden implements used in their weaving



A.M.N.H. photos

► FINE CHAMA POTTERY is still produced by modern craftsmen. Highly skilled and endowed with creative talents rooted in the folk art of the past, they need only better materials, intelligent adaptation, and the revival of techniques which are half forgotten



A.M.N.H. photo

◀ ARTISANS IN POTTERY grind local clays successfully by hand, but a tremendous variety of other ceramic materials that could be used to advantage has been discovered by the recent survey. Among those that await effective utilization include black clays of the northern coast, the pure white clay of Moyobamba, terra cotta shades of the Cuzco Valley, and the various body clays and paints of the Montaña hinterland



▼ FOLLOWING as best he can the traditions to which he is born, the native weaver displays inherent skill but knows little or nothing of the uses to which the world might put his products



▲ FOR SPINNING the wool into thread, the Indians have ingeniously improvised mechanical devices from old sewing machines and other spare parts. These speed the work and show the native's resourceful approach when there is any promise of a market for his wares

THE ANCIENT DYES, such as were used on the textile forming the background of this page, are largely a "lost art." They represent an almost incredible range of color, and excel those of any other primitive weavers



A.M.N.H. photo



▲ HAVING LOST the ancient colors, the native today falls back on "five-and-ten-cent-store" dyes in the weaving of his clothing

▼ A SOURCE OF RED DYE: cochineal insects living on a cactus plant used in the author's experiments to develop natural dyes for the textiles of Peru. Seeking information from witch doctors and in ancient records, he has experimented with 1500 plants and produced 250 useful, lasting vegetable dyes



Tourists who buy Indian-made ponchos, belts, saddlebags, etc., in Peruvian curio shops are apt to be disappointed later unless they have had the good fortune to obtain a rare piece. The colors are almost certain to fade, run when washed, or rub off. Yet the ancient weavings of Peru remain a delight to behold. Their glowing, beautiful colors have endured a thousand years of life.

My research in Lima found many persons with the theory of the ancient dye methods. But I could find no one who had actually extracted colors from native substances and transferred them to textile fibers. I was sent off on many a wild goose chase to remote villages by well-meaning persons who told me of Indians who still used the ancient methods. But I found very little to repay me for my travels.

As I went deeper, my friends at the Museo Nacional came to my assistance. They had found in their library an ancient manuscript written by a priest in a curious combination of ancient Spanish and Indian dialects. With difficulty the Señora in whose house I lived translated enough to give me important information. My frantic "S O S" to Washington also made available material as to methods of extracting colors. I began a series of tests.

I soon learned that most colors had to be extracted from fresh substances. My field trips already required considerable baggage—cameras, sketchbooks, water colors, typewriter, etc.—, but to these I added an electric plate and assorted pots. Electricity was available in most places for a few hours after dark, and into these few hours I crowded a lot of work. The circuits, however, were not designed for electric plates, and I blew out hotel fuses from Puno to Huanuco, while ambitiously stewing herbs, barks, roots, wild-flowers, and berries.

On one such trip I left a large collection of bottled juices in my Lima workshop. During my absence they fermented and finally blew up with terrific explosions. The juices shot upward to the ceiling and dripped down over the walls. When I returned I viewed the results with consternation, fully expecting to be thrown out of my quarters. But the good-natured Señora laughingly admired the colors.

From this a lesson was gained. I realized that a method must be found for preserving the colors, else seasonal materials would present a problem. Combining my efforts with those of a chemist, we hit on the answer—a substance used to stop the fermentation of cheese.

The patient Señora even submitted to my infecting her pet cactus garden with the dye-producing cochineal parasite (*at left*), to see if it would thrive in Lima. It did, to the destruction of the cactus.

In five months, with much enthusiastic assistance from the household, including the Indian servants, I was able to prepare formulas for 250 beautiful colors, tested on weaving fibers for fastness to light and washing. We made better than 1500 trials. All of the materials were sketched or photographed. We also pressed the more important specimens as a botanist would do, for future scientific identification.



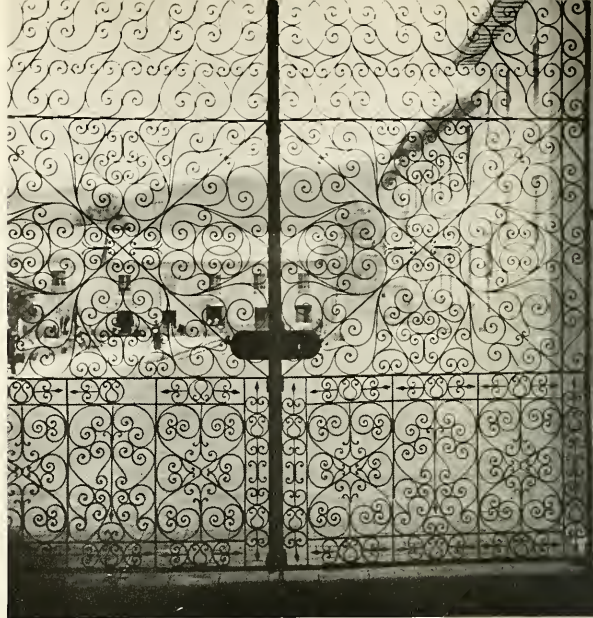
◀ WOOL for the finest weaving in Old Peru came from the vicuña, an animal which it has heretofore been thought impossible to breed in captivity



▲ A NEW SOURCE of super-fine fiber for weaving: one of the first farm-bred vicuñas. The new stock-breeding experiments have also succeeded in crossing the vicuña with the llama and alpaca

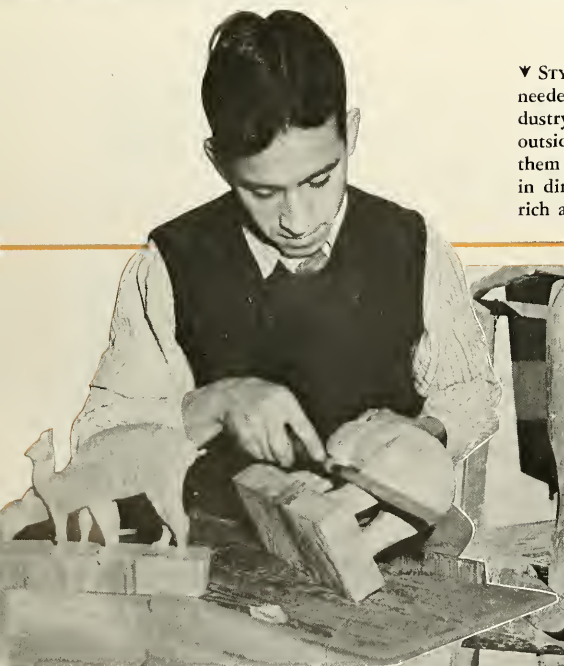
Two worlds have mingled
to make the Peru of today





◀ ONLY ONE PERUVIAN in ten is of the original Spanish stock, but especially in the cities the influence of their Old World culture is strong

▲ THE ART AND ARCHITECTURE of the Old World give beauty and grace to urban Peru and enrich the tradition and background of its people



▼ STYLING ASSISTANCE and technical improvement are all that are needed to give the latent talent its rightful expression. Manual industry projects are finding an eager following. Earlier advice from outside Peru had encouraged artists to copy foreign wares many of them machine-made. This only encouraged the production of goods in direct competition with established markets and suppressed the rich artistic traditions awaiting development



▲ PERUVIANS whose contact with the native Indian arts has been less intimate are nevertheless quick to get an idea, eager to learn

Peru presents some of the world's most incredible geographic contrasts. Where else could be found a country with such bold demarcations of barren desert, tremendous mountains, and tangled tropical jungles? These potent physical forces are found to have direct bearing on the economic, social, and cultural development of the future.

The long, low, narrow plain that fringes the coast is bone dry. Occasional rivers support small "islands" of habitation and agriculture, but to the greatest extent the hot sun beats down on a thirsty wasteland.

Each of the occasional oases is the site of a small pueblo. Lima, "the City of Kings," is near the Pacific in a fertile, irrigated valley. This bustling metropolitan city, modern capitol of the "land of the Inca," stands in such strong contrast with the rest of the country that Peruvians often describe their homeland as "Lima—and Peru!"

The formidable wall of the "Cordillera Blanca" rises steeply from the coast, flattens out to a lofty plateau varying in width from 100 to 300 miles, then as abruptly descends into the watershed of the Amazon Basin.

Life in this region of breath-taking elevations is sustained with difficulty. Yet, here lives the bulk of Peru's population, which is predominantly pure Indian. Development of this region involves complex problems. But when they are worked out, an incalculable new future will open up for the nation.



▲ THE BULK of the Indian population lives in the highlands up Peru. This is a spectacular wilderness of craggy peaks and ridges, separating the arid coastal plain from the jungle slopes of the Amazon headwaters. It is perhaps in this region that Indian tradition and crafts await their greatest development



▲ A THATCHED stone hut is the highland Indian's home. Primitive agriculture and stock-raising are his main occupations. Some of the herdsmen live at altitudes of 15,000 feet, and the snow-covered crests of the Andes rise to 20,000 feet



◀ THE MOUNTAIN INDIANS are able to travel great distances on foot and can resist cold and other hardships with unusual patience. Their homespun clothes and daily utensils retain many clues to the prehistoric ways of their ancestors



▲ CEREMONIES AND FESTIVALS that are observed in many localities keep even the children conscious of their cultural heritage. Their ancestors produced some of the most artistic weaving, silver and gold work, and ceramics that the New World can show

▼ IN CENTRAL PERU, valleys running chiefly north and south branch to make a maze of almost terrifying gorges and cliffs



The various elevations of Peru, more remarkable in some ways even than those of Mexico or Tibet, bring about every degree of climate from the equator to the polar regions. To this is joined a strange mix-up of seasons. When the cool mists of winter are rolling in over Lima, the tableland blooms with the freshness of spring.

It is delightfully nostalgic to discover that the seasons in the uplands parallel those of home north of the equator. April in Cuzco is a delightful month. The winter rains have not yet ceased and the nights are icy, but the days are soft and warm with the fragrance of the countless wildflowers that blanket the rolling hills. For a photographer the clouds pile up in billowy masses, painting grotesque shadows on the mountain sides.

The elevation, about 11,000 feet, is not uncomfortably high. It is usually only at altitudes above 13,000 feet that one begins to feel the discomfort of mountain sickness, or *soroche*. Even this usually lasts only a short time, if one is in good health. In spite of numerous hardships, there is a rare quality of beauty in the wild scenery of the cordillera and an atmosphere of mystery that gets into one's blood. Not the least fascinating part of this is the strangeness of the Indian, his rituals and his costumes, which vary with each pueblo.

On Easter Sunday, a year ago, I was in Sicuani, a small village near Cuzco. About midnight the eerie flutes (called *queñas*) and throaty drums of the Indians began a plaintive, repetitious melody, reminiscent of music I have heard in China. Coupled with this was the high-pitched chant of human voices.

I had retired early, exhausted from a hard day. Awakened by the sound, I listened for a time. Then, although curious, I rolled over and tried to get some sleep. Throughout the night the strange music droned on. I found little rest. I arose at dawn to see what was happening—then I was sorry I had not gotten up earlier.

The pueblo was teeming with Indians down from the high *punas* for Easter Sunday. Dance troops from distant villages were weaving strange patterns through the winding streets, to the tune of their primitive music. They were gaily costumed, masked with the heads of animals, goblins, and other queer creatures. This I was told had been going on all night; it continued until midafternoon, the dancers vying with one another for intricacy of pattern, the musicians attempting to outdo their fellows with sustained noise. They did not stop until they dropped from exhaustion.

From a quiet village, Sicuani was converted to a gay metropolis of laughing, handsome people, whose costumes were the finest I have ever seen. These were obviously made with thought and care, all hand-loomed from the finest wool, representing a skill at weaving that is traditional among the people of the highlands.

It is on occasions like this that the people who offer such a challenge reveal their full capabilities. In the market I saw wares that the markets of Lima, Cuzco, and other cities never see, things made for the ceremonial occasion and expressing the Indian's own interpretation.

I attempted to purchase some of the fine costumes. But they were not for sale. Poor as the people are



▲ ESPECIALLY IN THE VALLEYS of the northwest, picturesque villages derive their existence from agricultural pursuits

◀ FERTILE BOTTOM LANDS provide work for many natives on cotton, sugar, and grain plantations. Note that a train threads its way up this rich agricultural valley

▼ THE CASA HACIENDA is the operating center of the large farm. Many of the managers are encouraging workers to do craft work in off-hours and during off-seasons to improve their circumstances

in most respects, they like these fine things and don't wish to part with them. Unfortunately the Indians have been allowed so little margin of profit for their best decorative arts that they have become discouraged.

For example, at another village near Puno, called Huancane, I questioned the Indians regarding the prices put on the beautiful handweavings, in comparison with fabrics we would consider ordinary machine-made wares sold there. The machine products were the more expensive! What is more incredible is the fact that commercial interests are attempting to teach the Indian that his hand-loomed costume is a sign of barbarity, that he should be civilized and use the conventional attire of the white man!





▲ THOUSANDS OF NATIVES in the country live a simple life with few worldly possessions. Development of their arts in ways useful to the world about them is expected to preserve their legitimate pride in their true traditions and prevent the ills that result from loss of racial identity

◀ THE SIERRA is abundantly watered. Many of the tributaries of the Amazon begin their flow eastward from Peru. In fact, the true headwaters of the world's largest river originate in the everlasting snow of the Peruvian Cordillera. One of the two largest contributing rivers in Peru, the Ucayali, is navigable for several hundred miles

To reach the vast reservoir of materials that lie undeveloped in the Montaña, new roads are scaling the precipitous wall of the Andes, seeking their way through the snow-clad 16,000-foot passes and reaching into the towering rain forests of the jungle. This region is as rich as the Indies in woods, rubber, medicines, resins, spices, and other treasures.

The building of these imposing highways is a credit to the skill of Peru's new generation of engineers. They are successfully coping with the problems of swamplands, disease, poisonous snakes, and strange insects.

As the pioneers hew a path into the forest, farmlands are being cleared and the diseases are being eliminated by modern science. The climate is delightful. Curiously enough, one is reminded of Hawaii by the variety of exotic flowers, the huge stands of bamboo, the gigantic tree ferns, and the humid, mellow atmosphere. A strong parallel also exists in the grass skirts of the natives and in another material similar to tapa cloth. Only these people are not so clad for the benefit of tourists.

At present it is difficult to avail oneself of the store of materials so badly needed on the coast. I have seen and used the many beautiful woods, but in Lima it is virtually impossible to buy them. In the Montaña one sees magnificent decorative timber being used for bridge construction, mills, and other ordinary purposes.

It is equally true of many other undeveloped resources in Peru. But this work is groundwork for the future, and in the future they will all be readily available.

➤ THE HEAVILY FORESTED country of eastern Peru is called the Montaña. This is a storehouse of valuable materials useful in the crafts. At a recent exhibit more than 250 varieties of wood were shown, ranging from flame color through greens, yellows, and browns to white and black—the answer to a wood carver's dream



▲ HIGH PASSES lead the traveler over the lofty crests of the Andes to the rich and little-developed eastern slopes





▲ TYPICAL of the native folk arts that are not often seen on the market are amusing *toros* (bulls) and other animals for ceremonial use. This type is from the district of Pukara



▲ THIS STYLE of *toro* comes from Quinua, near Ayacucho. It is quite different from those of Pukara, illustrating the individualistic tastes of the Indian craftsmen. Both of these are of Spanish origin but retain the touch of the native artists

The objects shown on this page are a combination of modern folk arts and practical experiments in traditional techniques that are not being generally used in Peru.

It has been the object of the experiments to test techniques and materials, much as one would dig an exploratory shaft into a mine. From this humble beginning it is now intended to enlarge upon the experiments, with full knowledge of the need of modern markets.

The craftsmen who have been co-operating with the work are average, representing a typical cross-section. Yet their skills show great promise.

Not shown are the experiments being conducted in hand-weaving. By careful steps, immeasurable progress has been made toward fine hand-loomed fabrics, suitable for draperies, rugs, upholstering fabrics, clothing material, table linens, etc.

Experts know that the renowned fabrics of the past depended upon fine materials, beautifully wrought hand-spun thread, natural or vegetable dyes, and the ancient "hip-loom" which, for all its primitive aspects, has a flexi-

bility unobtainable in any other type. By developing these factors, we are already obtaining the desired thread from the original materials which are still available. Our research on the ancient colors provides us with an ample palette. And the "hip-loom" is still in active use by skilled hands. For design inspiration and study I have antique fabrics that include everything from tapestries and brocades to laces.

It is a definite aim of this work to keep well within the bounds of tradition, without attempting to retard the natural cultural growth of the people. Where new methods are desirable, they must necessarily be approached carefully. It has too often been the case that craftsmen introduced to modern technology or machinery, lose all sense of their native arts and submit to the new scheme, more guided by it than able to make it serve their needs.

The use of the "hip-loom" is an excellent example. When a better loom is developed to serve the needs of Peruvian craftsmen, they will quite naturally use it. But as matters stand it is still respected as the producer of their finest textiles.



▲ A CARVED GOURD depicting native scenes, costumes, and familiar animals. Skill for carving and design are everywhere available in Peru. These gourds come from the central highlands



A B C D E

▲ "A" is the border of a poncho from Huarcocondo; "B" a design from Tinta; "C" from San Pedro; "D" from Huancane; and "E" is an *alforja* or saddlebag from the northern coast. The designs all merge Indian and Spanish influences, but each village has its own distinctive motifs

► HOW MODERN THE ANCIENT. The left-hand piece is a modern wood-carving showing adaptation of an ancient ceramic to present-day functional use. On the bowl at right a design motif frequently seen on the ancient weavings has been applied by the ancient *kero* process to an ancient bowl shape; yet the effect is quite modern

► THIS BOX TOP illustrates a low relief carving of inlay in varicolored woods. The background is native walnut, the white flower petals are a wood from the Sierra, the green pod and the yellow stamen are both natural colored woods from the Montaña

▼ THESE GIGANTIC LEAVES which use the beautiful woods from the Montaña are 24 and 20 inches long. They are entirely hand-carved from single pieces of wood. They are practical decorative art, can be used for buffet service or as trays for fruit service. The circular dishes are turned on a lathe; but the beautiful woods, which should be seen in color, will find a ready market



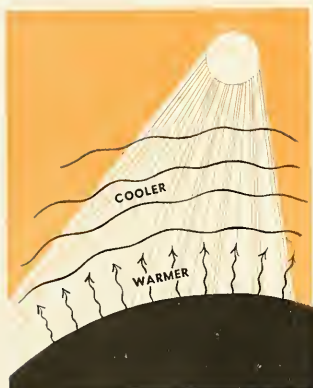
► THE NATIVE WOOD-CARVERS are highly skilled in the graceful flower patterns of Spanish tradition. The churches and fine homes of Peru contain many exquisite examples of colonial works of art, which provide splendid inspiration. The designs find functional use in furniture and decorative objects with utility



I am at present engaged in a fascinating experiment. At my residence we have set as our standard the beautiful ancient threads and have employed Sierra-bred women to duplicate this quality for us. They are creating a stock for dyeing, and in three months I have better than 100 pounds. A factual work record shows that they spin an average of 100 grams per day.

It is possible to arrive at an exact cost. We find that our fine thread is costing one-third by weight as much as the local price for coarse, loosely spun machine thread used for knitting sweaters!

Fact-finding like this has been extended to many things, and I am convinced that with thoughtful direction it will be possible to expand the work to a much broader base. With the co-operation of the many people involved—the Peruvian Government, the artists, the many private individuals whose effort has been unsparing—it is possible to create in Peru a type of native art that will be unique and highly sought after in the world's markets.



▲ ON A TYPICAL PICNIC DAY the sun's hot rays make the air directly above the land hotter than that higher up



▲ THE HOT AIR rising from the earth picks up moisture from streams, lakes, leaf surfaces, the breath of animals, and the damp soil



Even though it may be the most beautiful summer's day, these things may be taking place to mar your outing with a thunder storm

By H. E. VOKES

*Geologist, Geological Survey,
U. S. Dept. of the Interior*

This is June: the month of picnics, ants, and sudden showers of rain. As long as there are children, warm days, and indulgent parents, there will be picnics. As long as there are picnics and scattered bits of food, there will be ants at the picnic table. The relationship between cause and effect is fully obvious in this case, but is there also a relationship between picnics and the sudden showers that so often occur at the height of the festivities? The answer is yes, and the relationship is not far to be sought nor difficult to understand.

Picnic days are bright, warm, sunny days. They are days when the interior of the home seems stuffy and unattractive. The vagrant breezes that rustle through the trees possess a siren song that is peculiarly entrancing and irresistible. But the very warmth of the air that makes a picnic day serves also to make it a day for possible sudden showers.

As the bright rays of the sun are reflected from the surface of the earth, they warm the air immediately above that surface much more than they warmed the higher air through which they descended to reach it. The air being warmed expands and thus becomes lighter in weight. As it becomes lighter, it rises and is displaced by heavier, cooler air. And as the warmed air rises it carries with it water vapor that it has obtained through evaporation from the surface of streams, lakes, and other bodies of water, through transpiration from the leaves of trees and grass as well as from the breath of all living animals, and through capillary attraction and evaporation from the surface of the ground itself.

*Drawings by Museum's
Illustrators' Corps*

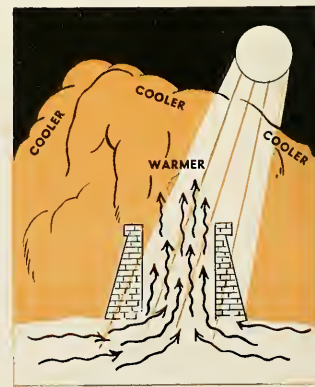
◀ AS THE MOISTURE-LADEN AIR rises, it expands and grows cooler. This causes the moisture in it to become visible as clouds

▶ THE OUTSIDE of the cloud becomes cooler than the inside when a mass of cool air comes in contact with it. Therefore, the inner part rises with a strong, chimney-like draft



While this warmed air rises higher and higher into the sky it is subjected to less and less atmospheric pressure, so that it is gradually permitted to expand more and more as it goes up. This expansion results in an equally gradual loss of its heat, and the air, therefore, cools as it ascends. When the temperature of the air falls far enough it reaches a stage known as the "dew point," where the water can no longer be retained as invisible vapor. It then condenses out as the very fine, suspended, water particles, which are the substance of clouds.

On a warm summer day the clouds formed from the water vapor in an ascending mass of humid air will assume the beautiful, cotton-wool, bil-





lowy shape which the scientists call "cumulous" clouds. The picnicker, unconcerned with their name, loves to watch and read from their ever-changing form imaginative pictures of great variety. It is a typically beautiful picnic day.

All the while the warm air is rising, its place is being taken by somewhat cooler air which, in its turn, may be warmed and rise to form more clouds. If the influx of this cooler air is just sufficient to balance the amount of warm air being displaced, the pic-

▼ **THUNDERHEADS** are formed—clouds known to the meteorologist as cumulo-nimbus. These are enormous churning masses of moisture-laden air



nicker may return home tired, dusty, and grumbling about the ants—having had a most successful day. However, if the current of cooler air becomes so strong and deep that its effect is eventually felt upon the cloud masses themselves, a storm is very likely to mar the picnic.

The new mass of cooler air is denser than the air in the cloud, and the latter begins to rise again. But the outer surface of the cloud is being made cooler than the inner part, so this inner part rises with a strong, chimney-like up-draft while the cooler, outer surface is swept in at the base to take its place. As a result the cloud piles up to a height that may reach as much as five miles, and the entire mass is churning in great convection currents, upward in the center and inward on the bottom. You and I generally know these high, somewhat anvil-shaped masses of clouds as "thunderheads," but to the meteorologist they are "cumulo-nimbus" clouds.

As condensation continues within the cloud, the drops of water grow larger until they become too big to remain suspended in the air and start to fall. Often they are swept inward at the base of the cloud, are caught in the strong up-drafts of its center, and are blown upward with great force, generally being blown to bits. Some of the drops will not be caught in the vortex of the great up-draft, however, and will churn around and round until they reach a size where their weight is sufficient to overcome the force of the upwelling currents. These will then fall free of the cloud and reach the earth. This is the reason why so many of our summer rainstorms are marked by the large size of the first drops of rain. These early raindrops aid in cooling (and thus in condensing) the air through which they fall and also cool the surface of the earth itself. This reduces the strength of the upward movement of warmed air from below the cloud and, together with the cooling of the cloud itself, gradually reduces the strength of the

Continued on page 287

► **IF THE NEGATIVELY** charged material accumulates in the upper part of the cloud while the positively charged elements remain at a lower level, a thunderbolt is in the making. Opposite electrical charges attract each other. When these overcome the resistance of atmospheric agents separating them, there is a flash of lightning



▲ **DROPS OF WATER** form within the cloud. Some are swept upward by rising air until they become heavy enough to fall as the first large drops



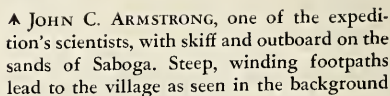
▲ **WHEN DROPS** are broken by a blast of air, a strong positive charge of electricity is developed in them, while the air and the finer particles are negative





Chairman, Department of Birds, The American Museum of Natural History

For an area so close to one of the world's great shipping and tourist ports, the Pearl Islands seem amazingly obscure. In the sixteenth century, especially between the dates of



Pearl Islands

[THE SECOND INSTALLMENT IN THE
STORY OF THE "ASKOY" EXPEDITION]

the founding of Panama and the conquest of Peru, they had fame aplenty. They were first visited in 1514, when Francisco Pizarro and Gaspar de Morales put the native Indians under the ruthless treatment that led before long to their practical extermination, after which they were replaced by Negroes. In 1522, Gil González de Avila is reported to have collected 146 pounds of pearls at the archipelago.

In the following century the islands were even more intimately familiar to British buccaneers, who constantly used the few protected anchorages for refitting ships, replenishing supplies and dividing booty. William Dampier reports that in 1685 the Pearl Islands were not inhabited by any whites but that the gentlemen of Panama main-

tained Negroes there to cultivate the plantations. Furthermore, the larger, forested islands sheltered at that date great numbers of runaway slaves, who hid in the woods by day and pillaged the crops and stock at night.

During the modern period, however, extremely little has been published about the Pearl Islands since shortly after the middle of the nineteenth century when matter-of-fact data were obtained for pilot books by a British hydrographic expedition. One brief account written by an American diplomat in 1917, and two or three papers from the specialized pens of zoologists, are all that I have been able to locate in the way of published records since 1900. It is noteworthy and surprising that the Cumu-

lative Index of a journal of such ubiquitous tastes as the National Geographic Magazine contains not a single reference to the Pearl Islands between 1899 and the present date.

"Askoy" spent two short working periods among *las Perlas*, namely, February 9th to 16th, during the dry season, and again May 23rd to 25th, after the rains had begun. For the first time, I landed on six of the islands, between Pañeca at the northern tip of the archipelago and the coasts of San José and San Miguel at the southern end. But four years earlier, in September, I had nosed in darkness into the middle of the group in cranky little "Wilpet" and, after a night at anchor under the shelter of Señora, had passed southward through



▲ YELLOW-CROWNED NIGHT HERON, a familiar fisherman around Pearl Island coasts

▲ MARINE BIOLOGISTS in action. Doctor Armstrong and Mate François haul a seine at Pañeca Island. At this early stage of the expedition, members of the "Askoy" party had not yet become sufficiently leather-skinned to bare their backs to the tropical sun

the broad, choppy channel, with San Miguel on the east and Pedro González and San José on the other beam.

Pedro González has several hamlets along its somewhat Polynesian-looking eastern shore (Correia stated that the Pearl Islands as a whole reminded him strongly of Tonga, in the western Pacific), but San José, next in size to San Miguel, has no inhabitants because the blacks know that it is haunted. My authority is Captain Lee B. Carr, of Balboa, master of "Wilpet" on our lunatic cruise of 1937. He had often voyaged to San José to hunt the pigs which are famous for toothsome flavor, and he informed me that behind the thickety shores, beset with gnarled and venomous manchineel trees, and beyond the sloughs and morasses of the winding inlets, there is beautiful upland covered with mighty towering tropical forest and little undergrowth.

About 80 years ago (around 1857), so runs the yarn which has all the earmarks of a dime thriller, an Englishman with his wife and young daughter built a homestead at San José, bringing also a stock of hogs. Indians came across the water from Darien and "massacred" (the word

is my skipper's) the man and the woman, but the child escaped into the bush and hid. Soon afterwards she was found, demented and white-haired (!), by some kindly Negroes from Pedro González. They took the girl into a sailing canoe and set forth for Panama, but she died en route. Since that day nobody has settled at San José and, according to Captain Carr, the natives cannot be persuaded even to land there.

I am of the opinion that even the most fanciful of tales are rarely made out of whole cloth. It seems probable that San José could support human life, even though its resources of potable water are far less adequate than those of Saboga or Pedro González. However, San José certainly supports a perennial and formidable plague of mosquitoes, from which some of the other islands are largely free. If we substitute such realistic ecological controls for the convenient term "haunted," we need carry our inquiry no further.

The first anchorage of "Askoy" among the Pearl Islands was a half mile off Pacheca. After a quiet night on board, Armstrong, Correia, the mate and I started off in the skiff

for a beach surrounded by rock walls. From this there proved to be no access either to the plateau or to adjacent shores, so we rowed to another section of strand from which Correia and I climbed out, leaving the others to their occupation with the seine, the fishes, the crabs, and what Dr. Fred-eric A. Lucas, a former Director of the American Museum of Natural History, used to call "iso-, amphi-, cope- and other pods."

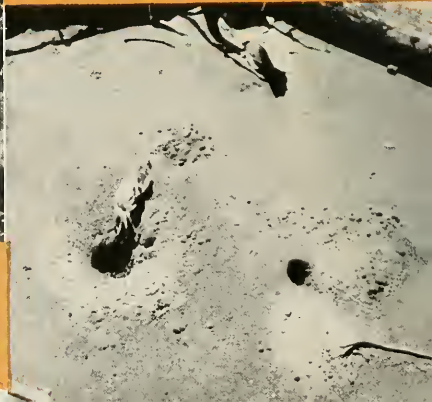
We were promptly discovered by a tiger-striped yellow dog, which yelped hysterically until we found its master, a Negro felling trees with what looked like a headsman's axe, the steel being broad and flaring and all on the blade side of its straight haft. He set down this tool, perhaps as a peaceful gesture, but at the same time picked up a machete. Correia and he entered, however, into a rapid and amiable conversation, all the more remarkable because it was conducted in two languages. At later dates, along the Colombian coast, a reiterated joke arose about my friend who was easily the most communicative member of "Askoy's" party, its general tenor being, "We cannot fathom Señor Correia's Spanish, but we have no difficulty in understanding his Portuguese!"

The Negro was engaged in the ancient method of clearing land for tillage, aiming to plant corn, beans, yams, papayas, and bananas among the stumps and prostrate trunks of the forest. He informed us that the Pacheca inhabitants were really only



▲ SABOGA has one or more species of "strangler figs" which grow to vast size. In the hollow of this one Comandante Fallon collected several bats

▼ CORAL-RED GHOST CRABS drill all sandy beaches in the Pearl Islands with their burrows. They feed by chewing mouthfuls of wet sand and thus extracting the nutriment of its microscopic life



summering folk who crossed over from more populous Saboga to work their small plantations during the dry season. He willingly agreed to guide Correia on a collecting trip and abandoned his axe but not the murderous-looking long knife. In Darien and the Chocó, however, the machete is to be regarded merely as part of man's attire, finding use throughout life for such simple necessities as severing the birth cord, hacking trails, butchering and dismembering hogs, cutting up food and bait, plowing the garden patches, husking coconuts, hewing out boats, trimming the timber for houses, fighting, and digging graves.

The skill and precision with which this tool is handled is astonishing. On the grounds of the Hotel Washington, in Colón, on an insufferably hot September day, I once watched a man trimming a grassy border with his machete. A power lawn mower had rolled over the plot, leaving an untouched strip about fifteen inches wide at the base of a concrete wall. Here the gardener stood, bending from the waist and cropping off the grass as clean as a shave. Moreover, he missed no stalk up to the wall itself, and yet I heard never a click of steel against cement. Merely to see him wield the blade close to the ground in long swinging strokes was enough to make one's back ache. Furthermore, while I did nothing more violent than to watch him, the sweat was streaming from every pore of my body, whereas



▲ LOOKING NORTHWARD from Saboga, a village perched on a hilltop. "Askoy" lies at anchor beyond the point, and at the right is the islet of Bartolomé

the toiler looked cool and comfortable.

Throughout the Chocó a good machete is recognized and coveted at sight by Negro and Indian alike. Many of those sold in the tropical market are made of poor iron, brightly nickel-plated and scabbarded in flashy stamped and fringed leather. Such are worthless junk, at which the self-respecting native turns up his nose. On the other hand, a true and ringing Hartford, Connecticut, blade, of good steel and equipped with cow's-horn handle plates, is worth its weight in silver.

The Pacheca settlement presented

a charming vista as we neared it. It stood on a tiny peninsula, with a shrine to the Virgin at the edge of the sea, six palm huts clustered behind a grove of coconuts along a curving beach at one side, two trim little fishing boats at anchor, and the jungly hill for a background. The men all wore two garments, the women one, the small children fewer—meaning nothing. Their bare feet were the best possible under-pinnings on the jagged rock that lined much of the coast, for they walked securely where we trod timorously in sneakers. This observation presaged still stronger evidence

THE "LEAVINGS" of a crab banquet. Each dot is a ball of sand that has been chewed and sucked dry of any food value. Such deposits line Pearl Island beaches until the rising tide obliterates them

▼ A HOME on Pedro Gonzalez

Photograph by James P. Chapin



of our own civilized softness which we encountered subsequently on the mainland coast. At Piñas Bay, for example, Negro pedestrians, "dressed up" and bound for a fiesta, would immediately remove their footgear whenever they left the smooth sand for a sharp, scoriaceous water front that approximated the hazards of broken glass. Not only economy, but also safety and even comfort, urged them to expose their own well-padded soles rather than the tanned cowhide of their precious, and probably only, shoes.

I left Correia with his dark crony, who was proving very genial, and joined my other companions in several hours of beach work before we returned to the schooner. In early afternoon I set off alone in the skiff to pick up our collector and his spoils, incidentally taking my gun, with designs on desirable sea birds along the way. It was anything but a sporting proposition because possession of the specimen rather than the thrill of shooting was my motive. Nevertheless, all but two victims were toppled in flight and some from high in air. The fact that I obtained thirteen birds by firing eleven shells gave me mild cause for satisfaction. The man-o'-war birds, brown pelicans, and oyster catchers, the first examples from the Gulf of Panama in our Museum collection, have proved to be indistinguishable from representatives of the same birds from the Atlantic side. All three of these species, in fact, fly freely back and forth across the Isthmus and can be seen in or above the Canal. Boobies, on the other hand, are sea birds that consistently sheer away from continental coasts and are never known to fly over large bodies of land. Because of these circumstances, it was interesting to note that the blue-footed and Chocó boobies taken on this day were both species peculiar to the coastal Pacific and unlike any of several kinds of boobies that inhabit the West Indies and the Caribbean Sea.

Pacheca is about a mile in length and 200 feet high along the cliffs of its southern shore. I started around the northern coast from the western end and soon entered new territory. But the colored people waved me on toward the east whenever I approached shore to inquire of the whereabouts of Correia, and I ended by rowing all around the island and back

to the ship without finding a trace of him. Before we finally concluded that cannibals had eaten him, however, he hallooed at us from the point nearest our anchorage, laden down with sea fowl and such unappetizing land birds as carrion hawks and one example of each of the two kinds of resident vultures.

That evening we removed to a beautiful and well-protected berth off the northeastern end of Saboga, where a boiling reef broke the swell from the north. This, in fact, has been known since the days of the buccaneers as the securest of Pearl Island havens. Two cheerful Africans came in a dugout, tried to sell us some inferior pearls, offered to pilot us southward, and sought orders for fish and fruit. Throughout most of the idyllic night of February 11th, the full moon gleamed on the strong, swirling, murmuring currents of this region of great tidal range, turned the beach into a snowy arc in the half light, and created an operatic setting for the squalid little village perched on the hilltop. Next day all of us labored at winding 2,000 feet of heavy dredging wire on the drum of one of our winches, and otherwise made ready and caught up, with the pleasant reliefs of a swim and a call from a visitor bringing papayas, bananas, limes, peppers, and coconuts. This same Sabogan also aspired to be a zoologist, for on a second trip to the schooner he delivered to Armstrong various crabs, mollusks, sea cucumbers, brittle stars, and a pair of the transparent shrimps, resembling rock crystal figurines, that live commensally inside the so-called pearl oyster.

Passers-by during the day included a company of 43 pelicans in single file, a giant manta or devilfish, five bombing planes, and a long canoe filled with fifteen or more blacks, bringing a sick man from Pacheca to Saboga. Also, an unexpected visitor anchored hard by, a United States Naval patrol craft which turned out to be the former "Vara." I had last seen her towing a cup-defender in Buzzards Bay! She came not by accident, as we duly understood, but rather to find out what deviltry we might be up to. The innocent visages of naturalists evidently made further credentials unnecessary, and three of us were entertained at dinner by Captain Cuyler Ten Eyck (of Albany, naturally) and five of his officers. It was pleasant to

associate not only with these gentlemen but also with spotless linen, table silver, bright illumination, electric fans, immaculate uniforms and, afterward, wicker armchairs on deck in the moonlight. When we returned to our own cramped little floating home, Robert François' bare, moist, and shining torso abruptly replaced the white coat of the "Vara's" courtly steward.

Nearly four months passed before the hospitable Sabogans were again able to show us that we were welcome and, by that time, *viejos* (old friends). In late May, Lieutenant Fallon, Correia, and I landed in order to see what we had missed before. We chinned with various aged men in the village, which looks lovely from every aspect in direct ratio to the distance from which it is viewed. These friendly old souls, together with the children, were not hampered by the curse of being busy, but the younger men kept on with their tasks until courtesy required an interruption. And the women, in trios, pounded clublike pestles into wooden rice mortars with a rhythmic concatenation—one, two, three, one, two, three.

The pearl fisheries, we were told, had become little more than a legend, despite the rosy tales still printed in the pilot books. As late as the middle of the nineteenth century, the inhabitants possessed an abundance of the gems, some of them as big as marbles. One mulatto of San Miguel was credited with owning \$100,000 worth.





Photograph by James P. Chapin

▲ PELICANS, including downy young and near-fledglings, at their nesting sites on Pedro Gonzalez Island. The brown pelican of the Pearl Islands is the same form that occurs along the southern Atlantic coast of the United States. It nests sometimes in trees and sometimes on the ground



Photograph by Willard G. Van Name

▲ MAN-O-WAR BIRDS, young and old, at their nests on Pacheca Island in the month of March



◀ SANTELMO BAY, of the great island of San Miguel, was a favorite feeding ground of hordes of brown pelicans. Accompanied by cormorants, laughing gulls and other species, they were capturing chiefly small fishes known as threadfins or *barbudos*

◀ CLIFFS rising from emerald water on the northwestern coast of Contadora. The other side of this island has a beach of golden sand upon which, according to tradition, the buccaneers used to divide their booty—whence the name *La Contadora*, the “Treasurer”

About 1871 the fishery inexplicably failed. Seven years later it enjoyed a brief revival, but thereafter the finding of pearls became rarer and rarer. This information from the elderly men of Saboga was somewhat surprising in view of the considerable pearl-fishing activity reported by Wicker as recently as 1917.¹ However, this author's account of the diving and of the purchases by Chinese buyers, specifically mentions only "seed pearls," one other gem worth eight dollars, and the sale of the mother-of-pearl shells at the rate of seven cents a pound. The church in Saboga village, which is now opened only at long intervals when a priest makes a pastoral voyage from Panama, has its steeple shingled with the historic pearl oyster shells, set in mortar.

We crossed Saboga by one trail and returned by another. From the beach on the western side we could see the heights of the Isthmus, Taboga Island, and the mountains of Chiriquí and Cape Mala. Bats, birds, lizards, and much else were added to our treasure, but to me the most entertaining creatures were strong-flying grasshoppers, five and a quarter inches long and with a wing-spread of nearly nine. The dimensions are taken from one that Fallon—big-game hunter—downed with a shotgun.

Saboga, as an example of tropical

land culture, has no doubt been abused for 400 years, and much of the vegetation is now scrubby and depauperate. Yet we found in the interior, glades and copses that were breath-taking and that made me think of Kipling's India. Some of the Negroes had admirable plantations of young coffee trees under the shade of well-spaced and extremely tall coco palms. There were also huge mangoes, and *higueros* (wild figs) with enormous buttresses, like walls. I stood in the twilight of such groves, saw the large burrows of blue-and-red land crabs, smelt the sharp odor of mangoes that had burst on the ground, heard the twitter of jewelled honeycreepers and the squeaky, rusty clatter of the *changamés* (great-tailed grackles), caught a glimpse of the dark crimson tanager that the Pearl Islanders call *sangre del toro* ("bull's blood") and, after a time, became aware also of the distant booming of the sea.

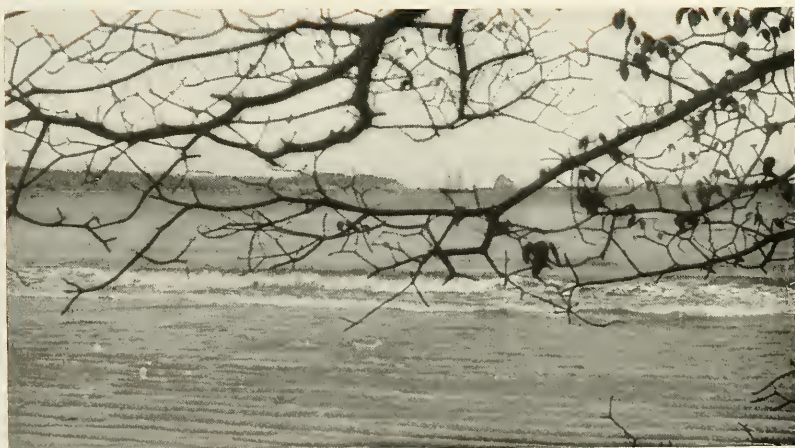
Contadora, only a half mile across the strait from Saboga, presented an extraordinary contrast at the same season. Its woods were thin and dry, although the rains had begun, at least feebly. The gulches were actually dusty; cactus (*Holocereus*) was growing on the rocks and on the limbs of trees around the cliffy coasts. Small birds were rare or wanting, notably the dozen or more kinds of flycatchers common on the neighboring "well-mosquitoed" islands. With no water

to drink, ghosts, such as those of San José, were not needed to account for the absence of men. John Armstrong in his diving operations realized here, however, one of the romantic side-aims of any oceanic expedition by finding a black pearl in a gigantic pinna shell. The same bivalve also contained two pearl-fishes with slinky bodies, tapering off to a threadlike tail. They are silvery, biologically degenerate little guests in the alimentary tracts of various invertebrates.

La Isla Contadora means the Treasurer's Isle, and tradition states that the long and broad sandy beach of its eastern shore was often made use of by the buccaneers for the division of spoil. At any rate, there are many records which indicate that no honest piratical crew of the period would tolerate a sharing of the loot until it had been spread out on a beach, within full and equal sight of the captains and of each participating rascal.

At the date of our first visit we had not yet been steeped in the incredible luxuriance of the Chocó, and the Pearl Islands, which really suffer by contrast, still seemed deceptively rich. Señora, which we passed at a distance in the molten forenoon calm, looked like the image of a dream. Through binoculars I could make out Panamanian fishermen sleeping under the canopy of an open boat, doubtless after a night's hard work on the water. Above them, and elongated as though

¹Cyrus F. Wicker. *The Pearl Islands of the Pacific*, Pan-American Magazine, vol. 24, 1917, pp. 223-234.



A "POISONOUS" VISTA of "Askoy" at anchor in the Ensenada Playa Grande, on the uninhabited island of San José. The tree is the notorious manchineel, more potent than poison ivy, which during four centuries has laid low unwary explorers

by a mirage, were vast trees, some of them bare of leaves but covered with pink blossoms, others peppered with roosting man-o'-war birds as thick as burrs on a chestnut.

We landed on the wild southern ocean front of San José, where the sea churns in caves and rocky arches, and where grotesque islets possess and deserve such titles as *Mono Ajumado* ("Soused Monkey"). Many stretches of beach are here barred by thickets of the notorious manchineel tree, which has a caustic and poisonous milky sap, similar in effect to that of poison ivy, but worse. Contact causes a severe inflammation, particularly dangerous to the eyes. Not profiting by hair-raising tales of the experiences of conquistadors and buccaneers with the manchineel, the carpenters of the British surveying ship "Herald" temporarily blinded themselves, in the middle of the last century, by incautiously cutting down one or more of these trees for lumber. Like many other dangers, they look disarmingly innocent, with their small sweet-smelling apples and leaves resembling those of a pear tree.

La Vivienda and San Miguel were the only other islands at which we went ashore. After leaving San José, we hauled our dredges across the shallow mouth of the strait toward the main island of the archipelago, rounded its long southern peninsula, and anchored hours after dark in Santelmo Bay abreast of the village of Mafafa, a name that surely sounds as though it had jumped from Africa.

Next morning we dredged again on the way toward a snug haven in a cove at the head of the bay, four miles inside the point. The catch in the great bag-net was scanty but entrancing, my memory recalling especially the sea urchins with gorgeous iridescent jewels scattered over their tests among the spines. The cove offered easy access to both rocky and sandy coasts, islets, and the mouth of a freshwater stream, the Río Cacique. Moreover, it was a feeding ground for some 400 pelicans, as many cormorants, boobies, migrant laughing gulls and royal terns from North America, and other sea fowl, so for two days we made it headquarters.

On the sandy delta of the Cacique we hauled the seine, taking a variety of fishes including the small threadfins upon which the pelicans and gulls were gorging, and a basketful of

puffers or blowfish no bigger than grapes, which they much resembled before their balloons collapsed. Wild swine were our fellow-collectors until the crack of a gun, by no means intended for them, sent them scampering to cover. Coral-red ghost crabs were the game that lured the pigs out of the bush at low tide. These crustaceans lived in holes a foot or so in depth. When feeding, they scooped up mouthfuls of wet sand, later ejecting a pellet the size of a pea after they had extracted all the microscopic nutritive contents. The crabs spent much time at the entrances to their tunnels, but now and then they withdrew to damper regions that protected them from the sun but not from the voracious razorbacks. Drove of the latter systematically quartered the exposed flats, rooted their way to the bottom of the burrows and gobbled up each crab in its cul-de-sac.

Callers were scarce in this thinly settled part of the Isla del Rey, as San Miguel is also called. One old codger and his daughter paddled out to the schooner laden with delicious apple-bananas and particularly large and excellent cooking plantains. For these he wanted either money, plug tobacco or salt, or a little of each. Nothing else interested him, least of all a pile of spare boards on deck which we offered to throw into the bargain. We hailed one other canoe, containing two men and a boy, and inquired for papayas and fresh fish. But the spokesman informed us—a little haughtily, I thought—that they were not fishermen but rice-planters. They would be pleased to do business in our rice orders, either immediately or for subsequent consignment but, as to fish or fruit, we must look elsewhere.

At one ramshackle but satisfyingly artistic wattle hut near the anchorage, we saw strung on cords in the open air a dozen or more split and dried iguanas and row upon row of eggs of the same creatures. Iguanas apparently furnish a good proportion of the islanders' meat. The fact that the supply still holds out, after centuries of hunting, is an indication of the relatively small human population. Several old books relating to Darien allege that iguana eggs are sometimes removed by a sort of Caesarian section, after which the unfortunate lizards are penned until they too, are required. At Piñas Bay we later heard stories of the reptiles being sewn up and set

free after the stripping of their un-laid eggs!

Correia was the only member of our party who wandered inland at San Miguel with his birding outfit. Shortly after he had fired his first shot, he stumbled upon a small community from which all the people were running away as fast as their legs could carry them. Two women, in their haste, had even lost or abandoned a four-year old boy. The youngster was bawling for his mother, so our puzzled collector took him in charge, led him by the hand, and carried him over the rough places. When he finally approached Negroes fearfully peeping from behind trees, the sight of the child in tow somewhat calmed them, and Correia's fluent tongue, even in an idiom only half familiar, did the rest.

The explanation was no less surprising than reasonable; the simple blacks had concluded that the war had at last reached their islands. Was there, after all, anything funny in the supposition? These people were not wholly out of touch with the world. Many of them could read, because the school régime seemed to be far more consistently maintained than that of the Church, and at Saboga we had met an intelligent and attractive colored school mistress whose cottage would be a credit to any community. Newspapers, not too old, were frequently obtained from the Panama fishermen. They knew that the current occupation of white men over much of the earth was killing one another. Furthermore, bombers roared above their most remote settlements at all hours; naval patrols popped constantly in and out of their harbors; submarines and their tenders maneuvered almost daily in deep water within sight of many shores.

And even in Santelmo Bay, where "Askoy" was properly sighted, investigated, and reported by scouting planes before sunrise of her first morning, the sky each night was spotted with flares and criss-crossed by the penetrating beams of searchlights on American men-of-war, perhaps many miles away. Sometimes it seemed to me, indeed, that in our out-of-the-world corner the empyreal fireworks should not be attributed to man's warlike contraptions, but rather to the patron of the bay, the good Saint Elmo himself, who has for ages laid over ships the glow of the corposant. (To be continued)



▲ OVER A DOZEN swallow-tailed kites were observed by the author during a single trip to the Cape Sable region



Photographs by Kenneth D. Morrison



▲ A BLACK-NECKED STILT approaches its nest

◀ DEEP LAKE, where an alligator swam about in the shadows of the cypress trees

OIL IN THE EVERGLADES

By KENNETH D. MORRISON

OIL DRILLS are pounding in the heart of the Florida Everglades. The first producing well in the State's history, located at Sunniland—30 miles from the southwest coast and 20 miles north of the Tamiami Trail—is netting about 100 barrels of petroleum a day.

For conservationists eager to prevent the destruction of a spectacular assemblage of wildlife and tropical vegetation found nowhere else within the borders of the United States, this is a call-to-arms. If the great Everglades region, part of which is proposed as a National Park, is to be spared destructive exploitation, action must be taken immediately to make certain that the production of oil entails a minimum of damage to the numberless natural assets of this exotic wilderness.

Oil wells eventually run dry, but the beauty and educational value of natural wonders remain as a heritage for future generations—if protected. The oil at Sunniland is low-grade, twenty gravity crude. The company has not yet been awarded \$50,000 by the State for the first well to produce oil in commercial quantity and quality. But it is likely that other derricks will appear over the landscape like a rash. It is reported that at least ten wells will soon be in the drilling stage, several of them within the Everglades National Park project area. These are amply financed. So it is imperative that all who realize the potential value of a National Park understand the importance of controlling the pollution that invariable results from drilling and pumping operations. It is up to the American public to demand that every precaution be taken.

Why worry, someone asks, about

Shall drills deliver the death-blow to a large section of Florida's irreplaceable wilderness?

the preservation of the Everglades when we are busy winning a war? True, the production of oil is of paramount importance just now. But we must not allow ourselves to forget the long-term value of the nation's only tropical national park. A small measure of vigilance now may save us lamentation after the war.

Tourists who once hurried across the Tamiami Trail remember the Everglades as a watery wilderness of peaceful disposition that basks lazily in the south Florida sun. Awkward herons and egrets splash about through the saw grass; buzzards circle over the Trail. Though man has created an artificial island two automobiles wide through a hundred miles of wilderness, he has so far been largely unsuccessful in his attempts to destroy the primitive character of the region. If pollution from oil drilling is uncontrolled, it will be a different story. As it is, the Everglades wears much the same cloak today as when its maze of uncharted water routes dismayed the Spanish conquistadores in the early sixteenth century.

But if the bold little Louisiana Herons that poke about the canals along the Tamiami Trail could worry, they and the rest of their avian acquaintances would have reason to be distraught. For it is of real consequence to the herons, ibises, and anhingas that the centuries-old quietude of their ancestral haunts is being violated by the clattering of oil drills.

The Everglades has remained a wildlife refuge only because man's attempts to exploit its surface have been

in part frustrated. Now it appears that liquid death may ooze up from the bowels of the earth to spread its polluting destruction through the fresh water which at present supports a flora and fauna that in abundance and variety can be duplicated nowhere in the world.

If wells in the Everglades can produce commercially profitable quantities of oil, the ecological consequences could be serious. There is great danger in any alteration of the biological balance which produces the microscopic plants and animals that serve as the diet of the minnows that are devoured by the multitudes of bizarre plume birds that give the somber Everglades a splash of color and an exotic enchantment.

Oil seepage would upset nature's delicate balance, which is seldom more complicated or more precariously poised than in a swamp. But there are other dangers. The possible escape of brines from drilling operations may even be a worse threat to wildlife than the seepage of oil. Adequate diking of these operations can prevent much of the damage to fish, wildlife, and vegetation that will otherwise occur.

A serious consequence of the discovery of oil in Florida will be to delay the establishment of the Everglades National Park. As early as 1934, Congress passed an act authorizing the creation of the park "at such time as all of the land described shall be made available by the State of Florida and can be turned over to the Department of the Interior in fee simple." Despite enthusiasm for the

project in south Florida, the State has been cautious about condemning the needed lands for fear of relinquishing to the Federal Government an area having potential value as an oil field. Now the project would seem to be doomed temporarily, even though the State would benefit in many ways from having the only tropical National Park in the United States.

The proposed park will cover roughly the southwest one-fourth of the Everglades. Rather than being regarded as "grabbers," proponents of the Park should be cited for their generosity in demanding that only a portion of one of America's most magnificent wildernesses be insured against human exploitation.

If and when established, the Everglades National Park will comprise 2000 square miles of flat, mostly freshwater marsh land ideal for a wildlife sanctuary. Though this area is penetrated by the Tamiami Trail, the water-covered lands adjacent to the highway are little more accessible to travelers than the seas are to the passengers on an ocean steamer. For the Trail is surrounded by a vast "moat." Those on the road look beyond what appear to be islands of vegetation to the distant horizons where great concentrations of ibises, herons, and egrets flap leisurely from one feeding ground to another. It is well for conservation that the only roadway across the 'glades is a narrow corridor.

For many years, Floridians who love the primitive charm of their Everglades have dreamed of setting aside a portion so that the original character of the region might be preserved for all time. Dr. David Fairchild, world famous scientist, was first president of the Everglades National Park Association, the organization which under the directorship of Ernest F. Coe is still leading the fight for estab-

lishment of the Park. "Seen at sunrise or near sunset," says Doctor Fairchild, "the 'glades of south Florida have a strange and to me appealing beauty. Their charm partakes of the charm of the Pacific islands. Their shell beaches remind me, with their groves and coconut palms, of beaches in Samoa and the Fiji Islands and Amboina and other islands in the Java sea that I have visited."

Speaking of the abundant areas characterized by deep soil and rich hardwood vegetation, Doctor Fairchild says, "In no other tropical region of the world have I seen anything like these hammocks. The nearest approach to them I encountered on the so-called Winneba plains of the African Gold Coast—but they lacked much of the beauty that characterizes the hammocks of Florida."

In addition to unique vegetation and rare birds such as roseate spoonbills, great white herons, wild turkeys, and others that are making a last desperate stand against man's intrusion, there is a great variety of animal life in the southern Everglades region. Wildcats and raccoons prowl at night. Deer and bear roam the cypress swamps. Men with restive eyes occasionally sight an alligator.

One morning in March, 1940, I found myself a perch on a fallen log extending a few feet over the water of a perfectly round little Everglades lake made shadowy and mysterious by the Spanish moss that dangled from towering cypress trees at the water's edge. My field glasses were trained on a swallow-tailed kite that was gyrating overhead, when a movement in the water on the opposite side of the lake, perhaps 150 feet away, diverted my attention. Only the top of the upper jaw of an alligator was visible as it moved silently between the lily pads, but it was a thrill worth coming far to experience.

The nature lover will be able to find a thrill a minute in the Everglades as long as the giant swamp is spared the blight of exploitation. The folly of draining the 'glades has been established. The National Resources Committee estimates that of the 4,477,810 acres that have been drained, only 377,000 would ever be agriculturally productive. It cost Florida over \$25,000,000 to prove to herself that she needs a gigantic freshwater swamp to generate the pressure necessary to prevent the infiltration of brackish water that would eventually doom her artesian wells. Florida disregarded the warnings of those who reminded the drainage promoters that there is nothing to prevent dry swamp lands from being plagued with fires. The warnings were well-founded. When the moisture was sapped out of the peat and muck, fires started that raged over nearly 2,000,000 acres in 1938-1939. The soil was completely burned out down to the limestone basin that underlies the 'glades. The disaster to wildlife was appalling.

Floridians have in part learned their lesson. They have placed locks to control the water levels at various points along the 440 miles of drainage canals that crisscross the southern part of the State. Before the discovery of oil, they were partially reconciled to the desirability of returning a large part of the 'glades to the stewardship of the Seminole Indians and the wild birds and animals.

It is doubtful that the Everglades can emerge from an oil boom with no more damage than was caused by the drainage fiasco. It is up to the nature-loving, conservation-minded public. They must see to it that the oil promoters do not leave in their wake a swath of spoliation that would nauseate those who knew the country when it belonged to the egrets and herons rather than to the buzzards and crows.

▼ PART OF AN AREA of peat soil destroyed by a sawgrass fire. Almost 2,000,000 acres in Florida suffered thus in 1938-39 because drainage promoters had turned a deaf ear to conservation advice

Soil Conservation Service Photos

▼ A SIMPLE, INEXPENSIVE DAM like this stabilizes the water level for 25 miles back and protects wildlife over a wide area

▲ SEEPAGE of oil and escape of brines released through drilling operations threaten the delicately balanced wildlife of the Everglades. Adequate dikes like that below can forestall much irreparable damage



NATURE'S GREATEST BONEHEAD WAS A DINOSAUR

Continued from page 251

cephalosaurus, (pakky-sef'-al-o-sawr'-us) by Brown and Schlaikjer from the Greek, *pachy*—"thick," *kephalos*—"head," *sauros*—"lizard" or "reptile." Which is just the scientific way of saying that this was a bone-headed reptile.

And it was. The skull of *Pachycephalosaurus* was about two feet in length, so it represented a dinosaur some 20 or more feet long—an animal three or four times as large as our small friend, *Troodon*. Since this dinosaur, like *Troodon*, was probably one that habitually walked on its hind legs, it may have stood some ten feet high. However, the impressive fact about this large skull was the amount of bone it contained, for like *Troodon*, *Pachycephalosaurus* was characterized by the great expansion of the skull roof above the brain case.

This was brought about by a thickening of the frontal and the parietal bones, which form the top part of the skull. In this large and peculiar dinosaur the thickening of these bones had gone to such lengths that there were some eight or nine inches of solid bone above the brain! And it *was* solid bone, too—dense and heavy, thick and massive.

To add to its peculiarities, *Pachycephalosaurus* was plentifully supplied with bumps, knobs, and points, liberally distributed over the nose, beneath the eyes, and around the back of the skull. Looking at this skull one cannot keep from thinking of a warty, bald-headed old man, with a fringe of stiff hair around the base of his pate.

Pachycephalosaurus wasn't a complete surprise to the paleontological world, for there was already *Troodon* to give some clue as to what this new dinosaur might be. Yet because of its large size, because of the great development of its bony head, and because of the numerous knobs and points that bedeck the skull, it was something of a curiosity—something to look at and think about. Even the most blasé student of fossils is brought up short in a kind of astonishment when first he views this skull.

In spite of the seeming peculiarities of this new dinosaur, it was not so mysterious, as soon as we became acquainted with it. Here we have the example of familiarity breeding, not contempt, but understanding. The

thing was strange only because it was new—as soon as it became well known it fitted into an integrated picture.

The key to *Pachycephalosaurus* is its small predecessor, *Troodon*. And the key to *Troodon* is a still earlier dinosaur known as *Camptosaurus*.

Camptosaurus (Camp'toe-sawr'-us) was one of the first of the Ornithischia, the order of dinosaurs having birdlike hip bones and including such beasts as the armored dinosaurs.* *Camptosaurus* appeared first in Jurassic times, well before *Troodon* and his descendants appeared on the scene.

Camptosaurus and his relatives, collectively known as the camptosaurs, were small to medium-size dinosaurs, generally bipedal—walking on the hind limbs. The forelimbs were, however, large enough so that these animals probably moved about in a four-footed manner when they were feeding. They were all plant-eating dinosaurs. In these dinosaurs the skull was rather small, long, and low. It was pierced on either side by the openings for the nostril, for the eye, and behind these, an opening to afford room for the bulging of the large temporal muscles that closed the jaws together. Moreover, there was an opening on either side on the top of the skull, also connected with the development of the jaw muscles. These are called the temporal openings. In front the jaws were rather beaklike, while back of this beaked region there was on each side a row of broad, leaflike or spatulate cutting teeth in both upper and lower jaw. Such was the primitive skull pattern from which the skulls of the later Ornithischia, the armored dinosaurs, the horned dinosaurs, and the duck-bills, developed.

Now when you look at the skull of *Troodon* you will see a long, horizontal line just above the eye and at the base of the dome which forms the top of the skull. Look at the skull below this line and you will see what is essentially a camptosaur skull, with, naturally, a few minor changes in proportions. This is the key to the troodont skull; it is, generally speaking, a camptosaur skull, with a big bulge or dome of solid bone added to the top. Viewed in this light its interpretation becomes simple; there is no mystery involved in deriving the troodont skull from its generalized camptosaur forerunner.

The same applies to the skeleton. The reduced troodont forelimbs may

be derived from the larger camptosaur forelimbs. The rather specialized troodont pelvis or hip bone, may be derived from the more generalized camptosaur hip bones, and the same holds true for the hind limbs. Thus the rise and development of the troodont dinosaurs becomes clear.

The process was carried farther in *Pachycephalosaurus*, with some frills added. And so we have the bone-headed dinosaurs, which at first sight seem so strange as to be almost unbelievable.

This explains the *how* of troodont evolution—it does not explain the *why* of their development. Why did the troodont dinosaurs evolve in the way they did? That is a different story, and the answer to it is not clear.

Modern genetics teaches us much as to the *why* of evolution, but to some problems there are still no answers. And this is one of them. It is a problem about which the paleontologist and the geneticist alike must speculate; that is as far as either science can go at the present time.

It is difficult to picture any real functional use for such a mass of bone in the head of the troodont dinosaurs. Was it to protect the brain? Perhaps, but mere brain protection would not require such a tremendous thickening of the skull; a fraction of the development would suffice. Moreover, the presence of such a great weight of bone in the skull would appear to us—at this great distance in time—to have been disadvantageous rather than otherwise. Some effort must have been required to hold up the weight of the head, even though the skull was "balanced" on the condyle—the articulation between the head and the neck.

What, then, was the reason for this great bony development? Perhaps there was no reason for it. Perhaps it was an hereditary development that had no functional significance, and even though it may have been somewhat disadvantageous, it was not enough of a handicap to affect the chances of survival in this group of dinosaurs for some time.

At any rate, this riddle as to the *why* of the troodont dinosaurs remains. It may be that sometime in the future the riddle will be solved. At the present the fact stands to confront us. Once there lived on earth the bone-headed dinosaurs, and of these *Pachycephalosaurus* was the ultimate bonehead.

*See NATURAL HISTORY, December, 1941.

NEW SKINS FOR OLD



By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON

ATOAD, when its skin gets old and tight, humps itself and splits its skin suit down the back, then down the underside. Like a man getting out of tight coveralls, the toad wriggles out of the old skin. Then it eats the castoff suit, stuffing it into a very wide mouth. Underneath the old skin a new skin has been growing,—soft and elastic when first exposed to the air, but soon hardening and becoming horny.

The skin of an animal separates the world outside from the living organized being within. It keeps out many enemies and keeps the body's fluids from escaping. Even in water animals the skin has many functions to perform, but when animals came to live on land, in the dry air, extra protection was necessary to avoid drying up. Some, like frogs, salamanders, and earthworms, keep a layer of watery mucus between their skins and the air. This incomplete conversion to life on land makes such creatures stay near the water or in moist places. Toads are much more at home on land, but even they remain in moist

earth during the daytime, coming out in the cooler, damper night or when it rains.

Lizards, snakes, and many insects have a still more efficient armor against

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dryness, an armor of horny plates with softer skin connecting them. The horny coat cannot be stretched much, and shedding this armor now and then may be an adaptation to permit growth. The shed skins of snakes are commonly found, usually in almost perfect condition. When a snake is ready to shed, its skin splits on the head. For a few days before shedding, snakes have imperfect eyesight, apparently while the skin of the eye is becoming detached from the deeper layer. The eye becomes clear again just before shedding, and after the old skin is cast off the new "glass" is quite transparent.

Mammals and birds have less horny skin; their fur and feathers aid the skin in its work. But even the soft skin of a mammal has a horny outer layer. Instead of being formed of plates, this layer consists of numerous, minute scales which are continuously being produced by the deeper layer of skin and continuously dropping off, or being rubbed off. We human beings rarely notice this process unless the scales are too abundant, like dandruff, or unless we have a sunburn. Then the outer layers of the skin come off in large pieces, exposing the delicate under layers.

A PHOTOGRAPHIC *Needle in the Haystack*

By T. DONALD CARTER

Assistant Curator, Recent Mammals, American Museum of Natural History

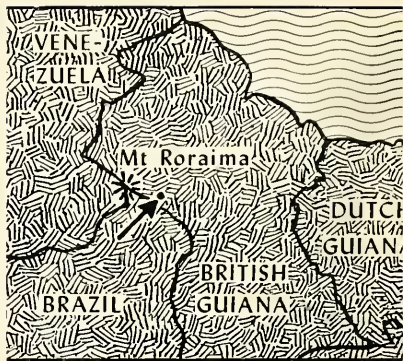
WHILE reading the article "Kaieleur and Roraima, The Great Falls and The Great Mountain of the Guianas," by Dr. Henry Edward Crampton, in the *National Geographic Magazine* for September 1920, I was attracted by the picture that is reproduced below at left. It is a scene in the vast, little-known interior along the British Guiana border. Exploring parties only occasionally penetrate this wilderness.

The picture which Doctor Crampton happened to take in this region had a strangely familiar appearance. Upon searching through the photographs I had brought back from an expedition almost seventeen years later, I found the one reproduced at right—a picture taken within a very few feet of the spot where Doctor Crampton had taken his. Both of us had pointed our cameras in exactly the same direction! When I showed both pictures to Doctor Crampton, he was naturally amused just as I was, and he kindly loaned me his negative.

Doctor Crampton had taken his picture on August 6, 1911, during his trip to the base of Mt. Roraima on an expedition for the American Museum of Natural History. He had just crossed the Ireng River and was headed for the tiresome journey across the hot savannas. My picture was taken on or about January 13, 1928, while I too was on an American Museum of Natural History expedition. We were on the way back to Georgetown after spending three weeks on the summit of Mt. Roraima. Our packers were about to go over the crest of the hill before descending

to the river, across which lies British Guiana.

It is interesting to note how slight are the changes after the sixteen and a half years that had elapsed between the taking of the two pictures, especially in the outline of the trees along the horizon. The arrow on the accompanying map shows where the two photographs were taken.



↓ 1911

↑ 1928



BOOKS

Continued from page 244

the primitive social organization of the forest Pygmies, and with horror at the doings of the Leopard Society. She actually wonders whether it might not have been better for the Congo if the cannibals had succeeded in eating Stanley. Modern tropical medicine interests her less than tales of native witchcraft.

The horrendous encounters with storm and flood, safari ants, black leopards, and potential cannibals must be taken with the proper journalistic discount; and we are totally unconvinced of the existence of the mulahu, a legendary super-gorilla. But these are Ellen's own experiences told gracefully and vivaciously. Maybe she deserves credit for taking them in her stride and hoping for more.

JAMES P. CHAPIN.

SCIENCE YEAR BOOK OF 1944

----- by John D. Ratcliff

Doubleday, Doran and Company, \$2.50

THIS is a collection of magazine articles on the various phases of science, both theoretical and applied, that have

CLOUDS, RAIN, AND PICNICS

Continued from page 273

up-draft within the cloud chimney. Then the smaller drops of rain will finally succeed in falling clear of the cloud, and our picnickers have to run for shelter as a general rain sets in.

What in all this is responsible for the brilliant flashes of lightning and the rumbling thunder that nearly always accompany these summer storms? It used to be held that these were a result of the friction developed within the cloud by the churning of the convection currents. Recent studies, however, assign a very different origin. An English meteorologist, George C. Simpson, discovered that the rupturing of drops of distilled water (and rainwater is distilled water) by blasts of air resulted in the development of a strong positive electrical charge in the broken particles of the drops, while the air around them, together with the finer particles of spray, had a negative charge. Applying the facts of this discovery to the conditions we know to exist within a cumulo-nimbus cloud, it would seem that when the falling drops of water are carried into the area of the central up-draft in the cloud and are broken up, the finer

spray particles will be carried up with the air while the larger remnants will remain at a lower level. Thus the negatively charged material will accumulate in the upper part of the cloud, while the positively charged elements will remain at a lower level.

Now in electrical charges, as in many other things, the rule is that opposites attract each other and, as the opposite electrical charges accumulate in the cloud, they tend to build up to the point where the power of their attraction to each other is sufficient to overcome the resistance of atmospheric agents separating them. When this occurs there is an almost instantaneous rush of the whole charge along a sinuous and often many-branched route from one point to another, generally from a higher to a lower point within the cloud or from within the cloud to the earth. This electrical discharge ruptures the air through which it passes, roughly forcing aside all of the atoms in its path and partially breaking from them their electrons which have made them normally neutral in electrical charge. In effect, the passage of the discharge forms a long vacuum tube whose walls are formed of free electrons and posi-

tively charged atoms. This condition cannot long remain, and there is an instantaneous rushing together into the vacuum of electrons and atoms. The reaction, designed both to fill the vacuum and to re-establish the neutral nature of the air mass, is a most violent one, and a portion of the energy generated by the collision is given off in a flash of light. This flash is our lightning. It is not caused by the actual passage of the electrical charge but is a result of the automatic repair of the damage done by that passage.

And the thunder which always accompanies the lightning? That is the result of the atoms being violently hurled aside by the charge as it darts through space. The effect of this is the same as that of a violent explosion, and the sound produced has exactly the same origin.

This is, in brief, the story of the events that occur before and during a summer shower and thunderstorm. As picnickers we may see in them only a conspiracy of the gods to spoil our pleasant day; as scientists we recognize in them the inevitable results of the workings of natural laws set in motion by the warm weather.

BOOKS

appeared during the past year. Mr. Ratcliff is responsible for the selection of these articles as well as for a 20-page introduction to the volume. This is the third time he has carried out a similar project, following the pattern of two predecessors.

It is evident that the writing included was selected on account of the timely interest and importance of the subject. The editor has also had in mind the accuracy and dependability of the story as well as its readability. The authors are first-rate journalists and good popularizers of science.

The book is divided into four sections, namely, "Medical Research," "Physics and Chemistry," "Agriculture and Nutrition," and "Aviation and Other Sciences." In the first we find ten articles on subjects like the following: Penicillin; Safe, Painless Childbirth; Front-Line Medicine; new Flu Fighters. In "Physics and Chemistry" we have five articles,—on Electronics, Radar, Betatron, Lightning, and the Sperry Gyroscope. In "Agriculture and Nutrition" there are seven articles,—among them, "Quinine Comes Home" and "Better Cows via Artificial Insemination." In "Aviation and Other Sciences," seven articles, among them Helicopters, Gliders, "The Stratosphere: Tomorrow's Airway," and "A New Weapon: Weather?"

This list, though by no means complete, indicates the breadth of treatment. The up-to-date accounts of the advances made in the various fields make fascinating

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▲ A SMALL FAMILY OF CHIPPING SPARROWS at the nest: a noteworthy photograph taken at Littleton, New Hampshire, by the Rev. Joseph R. Swain, of Bridgeport, Connecticut

PHOTOGRAPHY

Continued from page 247

into prominence, minimizes glare and reflection from water surfaces, shows the true color of tree leaves, and strengthens the color of any smooth surface. After you have used a polarizing filter and know its capabilities and limitations, you will use it more than any colored filter.

If you are interested in close-ups, bring your Proxars and Portra-lenses, or in distant views, your Distars and Teleks, and save yourself some enlarging later.

The wise thing to do for a film supply is to bring all that you think you will need. Probably there will be a limited supply wherever you go. However, don't buy out the store's supply.

Make every exposure count. You will have plenty of opportunity to study your subject and come to know it before you make any shots. By the time you are ready to return home, you should know your vacation land as well as your own back yard, maybe better.

BOOKS

Continued from page 287

reading. The story of "The Magic Top" (The Sperry Gyroscope) is enthralling, as is the one of the Radar (The No. 1 War Secret), and that of the Betatron, a new machine that whirls electrons at previously undreamed of velocities, the greatest velocities ever produced by any machine. The Betatron produces X-rays of greater intensity than any so far developed.

CLYDE FISHER.

HENRY S. PRITCHETT, A BIOGRAPHY

----- by Abraham Flexner

Columbia University Press, \$2.75

HENRY S. PRITCHETT was the son of an astronomer who was a student at Harvard College Observatory when Donati's Comet was "in all its superb glory." The enthusiastic interest of his father in the heavenly bodies doubtless had much to do in determining the profession of the son. In 1878 the latter was made Assistant Astronomer in the U. S. Naval Observatory. In 1882 he was astronomer-in-chief of an expedition to New Zealand to observe the transit of Venus. In 1883 he became Professor of Astronomy and Director of the Observatory at Washington University, St. Louis. He was leader of an expedition to observe the total eclipse of the Sun on January 1, 1889, in California.

In 1897 he was made Superintendent of the United States Coast and Geodetic Survey, a position he filled most efficiently for three years, which included the difficult period of the Spanish American War. He was instrumental in launching the Bureau of Standards as an independent organization.

At the age of 21, while still at the U. S. Naval Observatory, he was one of the founders of the Cosmos Club.

In 1900 he became President of the Massachusetts Institute of Technology.

After five years as the head of "Tech," he was chosen President of the Carnegie Foundation for the Advancement of Teaching, which he administered for some 30 years. It would be difficult to overestimate the value of his service to the teaching profession during this period, especially in American colleges and universities.

Certainly Dr. Abraham Flexner, who worked under Pritchett from 1908 to 1912, is better equipped than anyone else to write the biography of this scientist and educator. It will be remembered that it was Flexner who made the study of the medical schools of the United States and Canada, and published Bulletin Number Four as the report of this investigation. Without doubt this was the most important educational report of the period, judged by what it accomplished. Owing to its emphasis on higher standards, American medical schools have been reduced since that day from 155 to about 60.

This story of Doctor Pritchett's life will be welcomed by the many friends and admirers of this leader in education, as well as by all who are interested in our schools and colleges.

CLYDE FISHER.

GARDENS IN COLOR

----- by Richard Pratt,
with color photographs

----- by Edward Steichess

Garden City Publishing Company, \$1.98

THIS book needs no introduction to the flower gardener. It is a popular edition of "The Picture Garden Book," and as such it will be a most welcome addition to the shelves of the gardener who tends his or her plants with loving care and who wishes to make the best possible use of available space.

The book is beautifully illustrated, but the average gardener can scarcely hope to attain the perfection which was the subject of the photographs. However,

when we look back to our early days in the flower garden and remember our pride in our simple accomplishments, we can only think of how much better we might have done had there been available a guide such as this. The gardener will find innumerable aids in designing various "types" of ornamental gardens. For our own part, we should prefer a more direct approach to the problems—a clear statement of what the plants are, what we should expect of them, and just when we should do so and so—, but we might be wrong in our demands. After all, the sincere floriculturist likes to take time in deciding "just what should be there," and possibly the reader might like to solve his problems by jogging along with the author.

C. H. CURRAN.

AROUND THE HORN

A journal, December 10, 1861 to March 25, 1862.

----- by Edward Rowland Sill.

Edited with an introduction by Stanley T. Williams and Barbara D. Simison.

Yale University Press, \$2.00

THE unintentional author of this book was a poet and teacher of sufficient distinction to hold a place in the *Dictionary of American Biography*.

He graduated from Yale in 1861, a superior intellectual product of his generation but full of philosophic perplexities common in a period that had just become cognizant of Darwin. He was steeped in the classics, ancient and recent. The newest star in contemporary English poetry, namely Tennyson, seems, however, to have infected the youthful Sill with a bad case of puppy-love.

Sill and a classmate sailed from New York in the ship "Sierra Nevada" in December 1861, arriving at San Francisco in March 1862. The book is the author's journal of the voyage, illustrated by a selection of his pen sketches. In the main, it is trivial. In another sense, however, it



"Natural History"

ILLUSTRATIONS

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Above Illustrations: Part of Plains Group, American Museum of Natural History. Photo by T. L. Bierwert and C. H. Coles



is a significant fragment of Americana, offering fugitive reflections of the Civil War, the old shipping, the sea and other aspects of nature, as well as of a sensitive and unsure soul. It contains a few timeless passages but only a slight factual residue.

The work suffers from over-serious documentation. A plethora of footnotes gives explanations that the reader might be expected to know, or that don't matter anyway. For example: "This group of islands (Tierra del Fuego) lies at the southern extremity of South America" (1). Why must editors needlessly multiply their own chances of error, as by learnedly noting (footnote on page 37) that "Pompero" is the "American pronunciation of Pompero"? On the contrary, it is the correct or Spanish pronunciation.

R. C. M.

ATOMS IN ACTION

- - - by George Russell Harrison

Garden City Publishing Company, \$1.49

THIS is a revised edition of an excellent book with the same title and with the subtitle, "The World of Creative Physics." In this reprint there has been added a chapter on "Sciences in War and After." The author is a professor in the Department of Physics and Director of the Research Laboratory of Experimental Physics at the Massachusetts Institute of Technology. In 1939 he was awarded the Rumford Medal of the American Academy of Arts and Sciences for his contributions to spectrum photometry and spectrum analysis.

Rare among scientists he has the ability to write clearly and interestingly for the layman. The apt and imaginative titles of his seventeen chapters suggest the fascination of his stories;—"The Taming of Energy," "When Physics Goes Farming," "Sound Rides the Wire," "Glass—More Precious Than Rubies," "Sound Borrows Wings," "Outwitting the Weather,"—to mention just a few.

Dr. Arthur H. Compton, Nobel Prize Winner, writes of the book: "No book such as this could have been written before, for the science of physics has only recently shown the wide importance of its applications. Nor do I expect another presentation with comparable reliability, information, and human appeal for many years. It is a distinctive addition to the literature of modern science."

CLYDE FISHER.

THE WOODY PLANTS OF MAINE

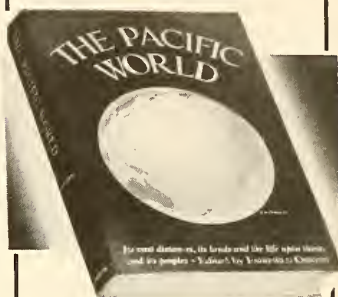
- - - - - by Fay Hyland and Ferdinand H. Steinmetz

The University Press, Orono, Maine, 50¢
72 pages, 10 illustrations; 1944.

A USEFUL and comprehensive catalogue of the woody spermatophytes of Maine, giving their distribution and including a bibliography of the literature relating to this subject.

THE PACIFIC WORLD

To be published June 19th



Edited by

Fairfield Osborn

President, New York Zoological Society

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Introduction by William Beebe

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Pronghorn Antelope • Humble Plants in the War Effort

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by Paul Radin

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Looking Ahead

WITH pride in the prowess shown by our successful and decisive contributions to victory in two hard-fought wars, we now dream of world leadership in almost all fields of civilized endeavor. Perhaps we overlook that the events which gave us the measure and confidence of our own strength also have given new strength to others, with the ultimate power to advance in peace as they have advanced in war.

In the early days of recorded knowledge both the problems and the material needs of science were relatively simple. The scientists still faced a long task of merely describing things as nature had provided them. The avenues of approach to a deeper understanding of the physical world around us first had to be discovered by simple observations of the natural objects and events of our environment. When, at length, sufficient approaches seemed revealed in the theories suggested by these observations, a further advance began. Theories were put to the test by artificial manipulation of the objects and events from which they had been derived.

As science learned to modify, control, and recombine the forces and materials of nature in its search for truth, it laid the foundations of modern industry. But the new methods of research also resulted in new needs for material equipment, and science became dependent upon the facilities and the economy of the industrial civilization it had itself created. Research in optical physics is completely dependent upon the products of the optical industry to which it gave birth, and upon the wealth of an industrial economy to provide for the cost of its expensive equipment. The development of modern scientific research has thus come to be closely associated with the development of industrial wealth.

This relationship is particularly obvious in the basic sciences of physics and chemistry. It is also becoming increasingly evident in the biological disciplines, although biological research in certain important fields must always remain more strongly linked to the agricultural than to the industrial way of life.

In terms of economic wealth and industrial power our country has reached a position of pre-eminence which is temporarily unchallenged by other nations. With it we have attained a genuinely earned prominence and excellence in the sciences, which now tempts us to indulge in the frequent expressions of a hope and desire to become the permanent world center for scientific research in the new era of civilization that will soon be dawning.

We have also grown to a strength in the arts which, with characteristic inconsistency, we ourselves refuse to recognize, while we continue to spend our substance in an effort to secure world dominance through the mere possession of the fruits of other cultural traditions. It is highly questionable whether the entertainment of these ambitions is logically sound or truly beneficial to ourselves and to the rest of the world.

Like most other revolutionary changes in the economic and social structure of human life, the industrial revolution was narrowly localized in its early stages. Beginning in England it rapidly spread to Germany and some of the smaller European countries, and to the United States, where it received a tremendous additional impetus from the development of modern mass production methods. The simultaneous development of the largest and most active centers of scientific research followed exactly the same pattern of geographic distribution. So long as industry was relatively centralized in a small number of countries, a corresponding centralization of research was not only possible but was the natural outgrowth of the circumstances, regardless of any deliberate effort to make it so.

But this early phase of the industrial civilization is rapidly nearing its end, and the war we are now fighting has greatly hastened the dawn of a new era in which the trend will be toward a diffusion instead of a centralization of industrial power. The prodigious performance of Russia's newly born and still imperfect industries, and the rapid spread of technical and mechanical knowledge among the Chinese in response to the necessities of war should have removed any doubts which may have existed concerning the direction of future developments. And the astounding growth of scientific institutions and activities in Russia has again attested to the close relationship between industrial and scientific progress.

In a period of industrial decentralization it therefore becomes an absolute anachronism for any nation to base its intellectual plans and aspirations upon the hope of becoming the world center for scientific effort and cultural progress. And the expression of such ambitions very easily takes on the appearance of an imperialism in the world of the mind, for which we would feel no sympathy in the world of physical existence and can expect no sympathy from others.

What we must expect, hope, and prepare for is a future in which there will not be any world center, but many cen-

ters throughout the world, willing to work together peacefully for the common goal of human progress, without the constant friction and threat to unity always arising from extravagant claims and aspirations to a supremacy that the world will never again be willing to grant.

If we maintain our cultural traditions and our high standards of education, many world leaders will continue to develop among us. But the concept of a world center in any branch of science or the arts will only mean the temporary bidding place of individual genius, which cannot be predetermined by material possessions when opportunity becomes universal.

In such a world we shall serve ourselves and civilization best by fitting our cultural institutions to the true needs of our own national life, without nebulous dreams of a world hegemony of scholarship. We must focus our artistic and scientific attention upon the problems nearest at hand, and let world leadership develop from the success with which each nation deals with its own natural concerns, as Russia has led in the sciences of the soil and the maritime nations in the sciences of the sea.

We must realize that the days are gone when even the finest collection of dead and preserved specimens could make New York rather than China the future center for research on Chinese natural history. And the countries that lose their old masters to the New World will have to find new masters for the old, and will be twice gainers by the bargain.

There will always be certain fields of scholarship both in the sciences and in the arts for which extensive, rather than intensive collections of material are required. Where approximate completeness on a world-wide scale already exists, it should therefore be maintained and further improved upon. But in an era of spreading industrial civilization with increasing abundance and opportunities for all nations, we shall no longer be measured by what we possess,—only by what we do,—and our acquisitions should not be based upon the fictitious value of mere possession but upon the true values which can only be derived from our ability to make the best possible use of what we acquire.

A. G. Barr

*Director, The American Museum
of Natural History.*

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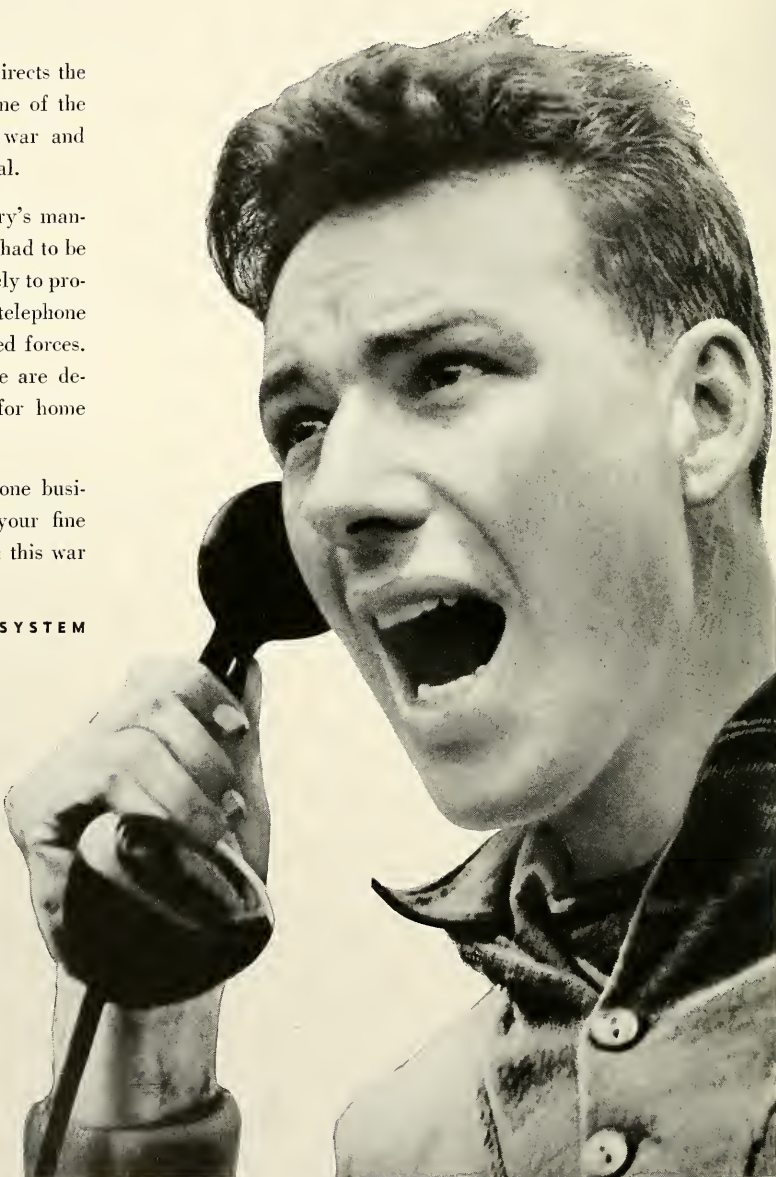
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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ALBERT E. PARR, Director

VOLUME LIII—No. 7

★ ★ ★ ★ ★ ★

SEPTEMBER, 1944

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SIRS:

I wish to offer a correction in regard to the use of Black Widow Spider silk for cross hairs in optical instruments, as discussed in William Carr's article "The Modern Nature Faker" (April, 1944).

It is true that the public should be discouraged from undertaking the production of additional spider fiber, but it is incorrect to imply that spider silk is *never* used in instruments other than surveying and laboratory instruments.

I was the first person to use silk of the Black Widow for optical precision instruments. I supply spider's silk to contractors for the U. S. Bureau of Aeronautics, certain branches of the Navy Department, Army Headquarters Supply Divisions of the War Department, as well as individual concerns for various types of aeronautical sighting devices as well as rifle telescopic sights.

Spider silk is not used in *general* in sighting devices; and other spiders produce silk that is decidedly preferable to Black Widow. But I have prepared Black Widow silk for use when the others were not available during the winter months.

Yucaipa, Calif.

NAN SONGER.

SIRS:

I found the article "Peoples of the Pacific" by H. L. Shapiro, Ph.D. . . . so timely and instructive that I wanted my son, Lieutenant James E. Gretham, U.S.N.R., now serving . . . in the Southwest Pacific, to enjoy it also.

In his letter of June 21 he thanks me for the copy I sent him and states that he, too, found the article and photographs most interesting. In fact, two weeks prior to receiving the magazine he had opportunity to observe and mingle with the Melanesians on a neighboring island that he was privileged to visit, where he found them in a much more primitive state than those encountered near the Base, and very much like the photographs and descriptions of them contained in Doctor Shapiro's article.

He has loaned the magazine to many of his friends and states that so many more want to read it that it is going the rounds with little chance of its immediate return. Several of the officers have asked that I send my copies of *NATURAL HISTORY* to him regularly, but I believe it is a better plan to enter him as a subscriber. . . .

Alexandria, Va.

W. D. GRETHAM.

Other readers with relatives in the Pacific area may be interested to know that this article, "Peoples of the Pacific," which has proved especially

popular, has been reprinted as a separate pamphlet, at 25¢ a copy plus 3¢ mailing. Orders should be sent to Man and Nature Publications, American Museum of Natural History, Central Park West at 79th Street, New York 24, N. Y.—ED.

SIRS:

I have received in excellent condition, though belatedly and very irregularly (copies for March and April came within a day of each other) your fine magazine, *NATURAL HISTORY*. . . I want you to know it means a great deal to me to receive and share this publication of yours every month. It ranks with a package of food or a letter from home. . . .

PVT. GEORGE L. STEIN.
c/o Postmaster, New York, N. Y.

SIRS:

It is discouraging to read "Oil in the Everglades" in the June *NATURAL HISTORY*, because the article has many misstatements and some overemphasis. This type of writing makes its appeal to so many people that the result is a confusion so general it cannot be repaired by a few of us who are trying to get the facts and make over-all plans for the development of the great Everglades region. . . . We are conservationists at heart but feel that planning can bring about oil development, agriculture, and water supply without too much injury to native plant and animal life.

The article gives the impression that large scale pollution will result from oil drilling, whereas our state laws and oil drilling practice prohibit and prevent such pollution, or at least keep it to a very small amount. The author assumes a dire result of disturbed "ecological consequence." As an ecologist, that doesn't seem the case to me. Drainage has already done the most harm. With regard to salt water seepage, this would be controlled by pumping salt water back into the deep strata. And it might be pointed out that while the fresh water marshland does prevent invasion of salt water near Miami, drainage does not affect most of Florida's wells, particularly the artesian ones which tap a deeper stratum. I feel that the loss through fires resulting from drainage is much overstated. Fires have done harm, but only a few inches or feet of peat have been actually burned off, and almost 200,000 acres of fine agricultural land have been provided.

JOHN H. DAVIS, JR.
Florida Geological Survey,
Tallahassee, Florida.

SIRS:

I have read and re-read the article "Oil in the Everglades" in the June issue of *NATURAL HISTORY*. I think it is unfair to the oil industry and does not emphasize the real danger to the Everglades.

In order to qualify my interest in the Everglades and in the establishment of a great tropical park to be handled by the Federal Government, I wish to state that for the past 60 years I have known the Everglades intimately. I have been completely around them many times, through them backward and forward many times, and probably know them in their entirety about as well as any white man.

I fear that for the present the Everglades National Park cannot be materialized, for the reason that oil has been found in the Everglades by drilling, which would naturally put a fictitious value on the lands owned by individuals. But that the finding of oil will damage the scenic beauty of the Everglades and its marvelous bird life is by no means a fact. Oil has been found only under small areas, and such small areas can be completely protected by throwing dikes around each producing well, when oil is encountered. Even if dikes are not thrown around a producing well, there is no reason for pollution, if the proper regulations to ward against damage are enforced; and I don't think there is an oil company in existence that would knowingly allow any damage to the wildlife or scenic beauty of the Everglades.

You may have heard of Bird City on Avery Island in Louisiana, which I established in 1892, and how successful it has been in bringing back the egrets and herons to the South. There is on Avery Island a considerable oil field, and along the road that bounds Bird City on its western edge great trucks loaded with pipe, and innumerable cars, pass daily. The edge of Bird City is also bounded by the Avery Island branch of the Southern Pacific Railroad. Herons and egrets nest within 20 feet of the much-traveled road and within 40 feet of the railroad.

In the open waters bordering the Louisiana coast there are at least a hundred or more producing oil wells today. There has never been pollution of any kind affecting the wildlife of this very populous bird coast.

What has ruined and still is ruining hundreds of thousands of acres of the Everglades is the attempt to drain large sections by diking and pumping. When these lands, whose top soil is almost pure humus, dry out and a fire is started, it is almost impossible to stop the fire, and I have seen hundreds of thousands of acres of the peat lands of the Everglades completely destroyed during dry seasons by fire.

E. A. McILHENNY.
McIlhenny Company, Avery Island, La.

SIRS:

As a member of the American Museum of Natural History for some twenty years, and an ardent reader of *NATURAL HISTORY* Magazine ever since its beginning, I was disturbed by Mr. Morrison's article, "Oil in the Everglades," in your June issue.

Continued on page 294

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at \$1.00 each, with full credit to the photographer. Return postage must be included.



New York's oldest inhabitant

ACCORDING to geological records the Phytosaur is one of the first known residents of the New York City area.

He lived about two hundred million years ago in what geologists call the Triassic period. A reptile about twelve feet in length, he had a curious beak-like snout armed with sharp teeth.

The Phytosaur was a crawler and a swimmer. In many ways he resembled our modern crocodile. But he differed in two important respects.

His nostrils were set back near his eyes instead of at the end of his snout. And the teeth at the tip of his snout were long and curved like nippers on a pair of tongs.

The Phytosaur was equipped in this strange way for a very good reason.

With his nostrils so far back, he could float along just under the surface with just the top of his head protruding, and thus sneak up on his unsuspecting prey.

As the Phytosaur illustrates, nature's creatures were fitted to the particular conditions under which they had to live.

But few of the earth's inhabitants have ever been able to protect themselves against the consequences of a sudden change in their environment.

Man is an exception.

Through insurance, he protects himself and his family against the consequences of sudden changes that might otherwise bring financial disaster.

If you should be deprived of your earning power because of injury following an accident, accident insurance will provide an income for you and your family and will pay your medical bills while you are forced to be away from your job.

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The tone of the article is misleading and annoying, as indicated by the use of such terms as "liquid death," "swath of spoliation," and "pollution that invariably results from drilling and pumping operations." The desire for preservation of Florida's natural assets is one in which oil men concur fully, but they will object to the article because it arouses unwarranted alarm as to the effect of oil operations.

Oil men generally have a high appreciation for the scenic beauty with which nature has endowed certain sections of the Nation, and they go out of their way to protect such beauty in the course of their operations. This has been demonstrated by the development in the marshes of Southern Louisiana, for example. To the best of our knowledge, the tremendous development of oil in Louisiana has been carried on with little, if any, detriment to the wildlife in the area. Recently eleven wells have been drilled immediately adjacent to and surrounding Avery Island, which is one of the greatest sanctuaries for bird life, without affecting wildlife propagation. There have been similar experiences in Galveston Bay and Laguna Madre in Texas, where oil developments have not disturbed the bird sanctuaries on Vingtneen Island and Bird Island.

In view of the fact that our Company completed the first producing oil well in Florida and has under lease a large acreage in the Everglades on which it expects to carry on considerable exploration work, you may be interested to know

that we have had several conferences with Mr. John H. Baker, Executive Director of the National Audubon Society, on the precautions necessary to protect wildlife in this area. Measures worked out jointly with this Society should provide protection for the wildlife of the Everglades and result in no greater disadvantages than would be incident to habitation for any other purpose.

There is no reason to expect any appreciable change in wildlife in the Everglades due to oil production.

JOHN R. SUMAN, *Vice-President*,
Humble Oil and Refining Co.,
Houston, Texas.

The conservation-minded public everywhere will acclaim the forethought and judgment that have been exercised, as explained above, by the Humble Oil Company and others of like mind.

Kenneth D. Morrison, the author, responds that his article might not have been written if most oil executives were members of the American Museum, or if the oil operations in the Everglades happened to merit the interest of only one or two oil companies. He also adds that the major point of his article was that harm to the Everglades *can* be extensive if oil operations are not controlled and that this statement is corroborated by both geologists and wildlife biologists.

The article, needless to say, was

read and approved by conservation leaders prior to its publication.

To leave the impression that there is no conflict between conservation and commercial interests would be wrong. Differences of opinion, often emphatic ones, are the rule rather than the exception. And public sentiment has been the leading force toward conservation progress.

—Ed.

SIRS:

I would like to express my appreciation of the very fine conservation article "Oil in the Everglades" by Kenneth D. Morrison. . . .

I have been making every effort possible now since 1939 to try and have the "Singer Wildlife Refuge," which is located within the parish of Madison in our State, saved for us and for posterity. This area is not only the last habitat of the ivory-billed woodpecker but is an area rich in the animal and plant life characteristic of this type of country.

On many of our conservation maps the section has been designated as a wildlife refuge. However, no legal provision was made for keeping intact any of the area. At one time it comprised some 80,000 acres of virgin bottom land forests, but now, since the cutting by a lumber concern, there remain only about 7,000 acres. . . .

HENRY B. CHASE, JR.
New Orleans, La.

SIRS:

It is with interest that we have noted in NATURAL HISTORY Magazine over the past two years a number of articles on various areas of the National Park Service. We were particularly gratified to note the extensively illustrated article appearing in the May, 1944, issue by Joyce and Josef Muench, "Cities in the Sun." This article contains excellent photographs of archaeological areas under the jurisdiction of this office.

We extend congratulations for the excellence of the articles and their wide scope, and sincerely hope for their continuance.

M. R. TILLOTSON,
Regional Director,
United States Department of the Interior,
National Park Service Region Three,
Santa Fe, New Mexico.

SIRS:

Just a word of congratulation upon the most excellent June number of NATURAL HISTORY. It covers a wide variety of fields of interest in a most entertaining and attractive manner. This letter is really motivated by the pictorial article on the Olympic wilderness. Such pictorial articles are a fine contribution to an understanding of many subjects by laymen.

I also enjoyed very much William Carr's recent article on "Nature Faking." Your book reviews are also of much interest and so helpful that they are used as a basis for ordering books to keep up with the times.

ARTHUR BEVAN,
State Geologist,
Virginia Conservation Commission,
Charlottesville, Virginia.

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SIRS:

Just a few lines to thank you ever so much for the November and December issues of NATURAL HISTORY.

One of the greatest assets of NATURAL HISTORY is that all numbers are equally excellent, a standard that very few magazines have achieved. My wife and son have as much delight in perusing each number as soon as it arrives, and many of the photographs bring "saudades" of the few visits which we made to the American Museum of Natural History.

JOHN LANE.

Sao Paulo, Brazil.

SIRS:

I am interested to know whether farmers' claims that snakes can "milk cows" and "drink milk from bottles standing in the cellar" can be corroborated by scientists' observations.

(Mrs.) RUTH S. LILIENTHAL.

Brooklyn, N. Y.

The belief that snakes extract milk from cows is extremely widespread, and in all probability it originated not long after cows came into general use as domesticated animals.

As a matter of historical interest, the name *Boa*, now used as a scientific as well as a vernacular name, is associated with the ancient fable. The Reverend Charles Owen, in a remarkable compendium of both information and misinformation entitled *An Essay toward a Natural History of Serpents* (published in London in 1872), records that "The Serpent de Boa is another of the monstrous kind; called *Boa* from *Boa*, the Latin word for an Ox, which it devours at once: The young ones, which grow to great Bulk, are nourished by sucking the Cow." The origin of the name "*Boa*" is thus correctly explained, but the habits and capabilities of the snakes are overstated, to put it mildly.

This ancient yarn has penetrated all parts of the civilized world. It is amazing that the myth is so widely believed, more particularly because it has been so frequently exploded. Clifford H. Pope in his *Snakes Alive and How They Live* (published in 1939), even took the trouble to include a photograph of a "milk-snake" (the accepted common name for one of the kingsnakes) coiled beside a glass of milk in order to demonstrate that a snake of such dimensions could scarcely consume more than a few ounces in a week, even if it were interested in a fare so far removed from a snake's normal diet.

Numerous other authors have explained the impossibility of a snake's extracting milk from a cow's udder. Whereas a snake swallows its prey by shifting its jaws forward on alternate sides, the lips are not manipulated in a manner that would permit the snake to seize a teat and suck—even if the cow were sufficiently patient to endure the penetration of numerous needlelike teeth present in the jaws of most snakes.

Thus there is no factual foundation for the yarn; but in most regions the snake locally called a "milk-snake" is one that frequents barns or stables. However, the snake has not chosen this abode because he cares one way or another about milk. Serpents frequent barns and stables for the

simple reason that fodder for the stock invariably attracts rodents, upon which the snakes can prey.

Whether snakes drink milk from pans or possibly even from bottles is another question. Again our friend, the Reverend Owen, this time within the realm of possibility despite exaggeration, reports that the "Long Black-Snake . . . very much haunts Dairy-houses . . . and makes very free with unguarded Milk-Pans, and Cream-Pots." Without much doubt a thirsty snake might, on occasion, drink milk, not because it was milk but because it chanced to be the most readily available source of moisture. The same snake would accept water from a muddy pool for precisely the same reason, definitely not because he preferred the soil particles suspended in the liquid.

This should close the discussion, but I cannot refrain from adding that this note will inevitably elicit letters from a few people who claim they have actual evidence of snakes "sucking milk from cows." A radio program back in 1939 brought a number of such responses, but significantly enough they were either second- or third-hand reports, or the observations had been made anywhere from 30 to 50 years ago!

CHARLES M. BOGERT, *Curator,*
Recent Amphibians and Reptiles.
The American Museum of Natural History,
New York, N. Y.

SIRS:

I am wondering whether you have ever considered running a question and answer column in your magazine. As for me, I would like nothing better, as I am constantly being asked questions. For instance, does the hair on the heads that the Jivaro Indians shrink for ceremonial purposes continue to grow for a while after the heads are shrunken, or do the Indians wear their hair long? . . .

(Mrs. R. M.) OLIVE M. GUNNISON,
Quaker Hill Museum of Natural History,
Pawling, N. Y.

The hair does not continue to grow after the heads are shrunken, and as far as we know is left at its original length. When the Jivaro Indians shrink a head they cut out a considerable portion of the scalp and the hair with it. Otherwise there would be too much hair in relation to the head.¹

JUNIOUS BIRD,
Assistant Curator, Anthropology,
American Museum of Natural History,
New York, N. Y.

SIRS:

Temperatures and other phenomena of the stratosphere, which were interestingly discussed by Dr. Hobart E. Stocking in "Up from the Depths" in your December, 1943, issue, are of continuously increasing importance to science and to aviation as airplanes are built to go higher and higher. Thus it may be of interest to many persons that some conditions in the stratosphere vary markedly from the general averages which Doctor Stocking gave.

In particular, temperatures in the air

¹ Some further information on shrunken heads is given in an article in the January, 1937, issue of NATURAL HISTORY, page 64.

Continued on inside back cover

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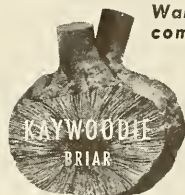


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BEAR MOUNTAIN

By WILLIAM H. CARR

Director of the Bear Mountain Trailside
Museums
Associate Curator, The American
Museum of Natural History

Bears

*All photographs from Palisades
Interstate Park, by Whitford*

Through the unending assertion of their personal peculiarities, the bears at a large wildlife park continually make things lively for the men who introduce them to thousands of visitors each year

IN regions where guns blaze during hunting seasons, the American Black Bear often becomes a galloping, shadowy form, vaguely seen by human beings as he retreats swiftly through the trees. In a large western National Park, under complete protection from hunters, the animal may approach visitors and demand food. Described in terms of human behavior, he is an opportunist. On intimate acquaintance, he keeps one guessing, for he is thoroughly capable of springing many and varied surprises. As the books say, his brains shows "distinct convolutions."

We have been on familiar terms

with a number of black bears for many years. They live in a two-acre enclosure, appropriately enough in New York's large recreational and wildlife preserve, Bear Mountain State Park. A wide brook flows through their spacious quarters, tall hemlocks and oaks offer protection from the summer sun, and a huge wall deflects the winds of winter. The shaggy-coated animals are probably as happy as any that do not enjoy complete freedom.

Every spring we face the problem of rescuing and rearing from one to five little cubs, for their mothers, Goldie and Elsie, are no strangers to

the stork. Elsie waited for the remarkable period of nineteen years before experiencing the joys of parenthood. Perhaps this long delay may, in some strange way, account for the fact that her offspring are, as a rule, more gentle and tractable than Goldie's little ruffians. Both mothers are brown or cinnamon, which is another way of saying that they are color varieties of the typical black bear. Three large coal black males share the enclosure with the matrons, and to this fact we attribute the difficulties that arise when the pudgy youngsters make their first appearance in the light of day.

▼ EVENTUALLY the cubs learn that nourishment will come to them only via the rubber nipple



We have learned through bitter experience that our adult male bears will kill the young ones on slight provocation, and this we prevent by removing the cubs from the enclosure when they are old enough to be separated from their mothers. When the cubs are born, in February, the mothers are voluntarily confined to their dens, Elsie's beneath a side wall and Goldie's in the center of the enclosure. The males occupy other lairs. As long as this period of separation lasts, all is well.

As the sun becomes warmer, usually in early April, the cubs approach the den exit and gaze upon a fascinating, strange new world. At first they step out for a matter of a few feet, testing the air with their comical noses and retreating at the slightest sound or motion. The mothers are especially vigilant and alert. If a male bear makes the mistake of coming too close, the cubs are sent tumbling into the den and the mother rushes upon the intruder and cuffs him furiously until he decides the view is better elsewhere.

Within a few weeks of the initial escape from darkness, the cubs are no longer content with a doorway view. The time has come to enjoy the real sights and sounds of the open. There is the brook to explore, tree trunks to be examined, and a hundred and one other objects to be investigated. All goes well at first, for the large mother is always present and the young, covered by her rear guard action, make a quick rush for the dens whenever a male comes too close. The tragedies that have occurred have been the result of a single, overbold cub straying too far from its mother and thus falling victim to one of the black fellows ever hovering on the outer fringe of the mother's protective circuit.

One spring Goldie had three little bears to watch, her first triplets. A week before we were ready to remove the cubs, death struck suddenly. The three cubs and the mother were out for a brief stroll when the playful little ones separated and dashed off in different directions. Waiting for one of them was "Peanuts," a particularly unpleasant bear which has since been shipped to pastures new. He rushed upon the luckless cub and killed it instantly. Goldie ran back to the cave, left her now thoroughly frightened cubs in the darkness and dashed out to do battle. When she



▲ "MORE people think they know how to bring up bear cubs!"

reached her slain cub, her fierce demeanor subsided. She licked it and nuzzled it for some minutes and then to our surprise picked it up in her mouth, holding it by the neck, and carried it into the den.

We realized, of course, that we had waited too long and that the affair was partly our fault. Consequently, we immediately set about removing the remaining two cubs. Our original plans for this procedure would have involved considerable preparation, so we had to devise a new system on the spot. It was a most difficult undertaking, for all of the bears were upset, not just Goldie and her cubs. There had been a great deal of noise made by the homicidal Peanuts, by the unfortunate cub, and by the bereaved mother. The bears were still "talking" about it in rumbling voices. A large crowd of people had assembled to watch and to discuss the affair in loud tones, further hampering us.

Our little board of strategy decided that the best thing was to lower a

large sack, with an iron hoop holding it open at the mouth, down into the enclosure so it would be in front of the den. We believed that if one of the small bears should venture outside, he would step into the sack and we could quickly pull him upward. Goldie seemed to guess what we were up to. She rushed outside, grasped the rope and the bag and chewed upon them viciously. Then she dragged them into her den where they were almost concealed from view, but not quite. Poor Goldie, she helped us unwittingly, for the open-mouthed bag lay within the den in such fashion that it was admirably suited to our purpose.

Tensely we watched and kept a firm grip upon the rope. Presently, one of the little fellows appeared near the entrance, sniffed the strange bag, tested the rope with his red tongue, and then to our delight commenced to play with the intriguing paraphernalia. In an instant he had rolled into the center of it and quicker than a flash, we pulled away. He at once

fell to the bottom of the deep sack and he was ours, a howling, squalling, clawing, biting little fury. His mother, hearing the loud bawling, rushed out of the den entrance but failed to locate the source of her young one's cry for help.

By great good fortune we were able to repeat the bag-lowering process and both cubs were forever removed from the threat of slaughter. Goldie searched the entire enclosure for the rest of the day, calling as she went. The next morning found her in the pool enjoying a swim. She ate her food as before and to all intents and purposes had forgotten past events.

Many are the adventures we have had in connection with bear rescue work. One of the most exciting involved two of Elsie's cubs. When the time came to remove them, we believed that our scheme was perfect. Elsie's den can easily be reached through a manhole from above. A

large grating over the front entrance to the bears' den may be lowered whenever needed, to keep the animals either in or out of the den. We enticed the mother outside with loaves of bread and then quickly lowered the grating. When Elsie heard the sound of the gate being dropped she rushed at the bars. We quickly raised the manhole cover and prepared to descend into the den. The cubs were lying directly beneath us in plain sight. We lowered a bag to put them in and dropped our feet over the edge, when, to our great surprise, there was Elsie, 250 pounds of very unhappy black bear, right beneath us, looking upward. We did not stay in that neighborhood very long, and the manhole cover was unceremoniously dropped into place.

To this day we have never determined how Elsie gained entrance to the den. The iron bars were very heavy and thick. It seemed impossible for her to squeeze through at any

point. The grating was still in place between the side channels which supported it. The iron peg, which prevented it from being lifted up and dropped again, was undisturbed. Several newspaper reporters were watching the proceedings from good points of vantage. All they could say was that one minute Elsie was outside and the next she was nowhere to be seen. It is small wonder that they called her Houdini when they wrote their stories. Eventually, we succeeded in removing the cubs, but not before we had dropped an additional grate in front of the original one.

There was the time when Goldie departed from the enclosure altogether, accompanied by her two cubs of the season. This escape was also a mystery which was not solved until months later when another bear repeated the process before the eyes of its keeper. But that is not the story. On the day Goldie made her bid for freedom, we were expecting some five thousand children on one of the Hudson River excursion boats. Goldie walked abroad at ten in the morning and the boat was due at noon. The large bear, by no stretch of the imagination, could be considered tame. She was perched in the top of a small oak tree when first discovered, and the two cubs were enjoying themselves hugely, cavorting about the tree top chewing nice fresh, green leaves. It was June and all was well with the cubs but not with us. We believed that it was decidedly unsafe to have a big mother bear at large simultaneously with five thousand high school children. When we conveyed our ideas to Goldie, from a safe place at the foot of the tree, she simply said, "Whoomff!"

It became quickly evident that there was nothing to be gained by soliciting Goldie's co-operation. She had her eyes on the hills, not on the near-by enclosure, and the cubs were concerned about nothing in particular except having a good time, occasionally much to their mother's annoyance. We collected a large group of men and secured a roll of strong fence wire some twelve feet high. This was unrolled and placed upright forming a barricade around Goldie's perch, some 20 feet from the tree trunk. She attempted to come down several times during this procedure, but we discouraged her by rapping soundly upon the base of the tree with baseball bats. Eventually

▼ TIRED BUT HAPPY. Contented throaty noises accompany the evening meal



the fence was in place, whereupon we dragged a heavy transportation cage, equipped with a sliding gate, to one side and placed it to form the apex of an approximate triangle.

It is surprising what sideline bravery some people will display who do not know that bears are not to be handled lightly, especially bears with cubs to protect. During all of the proceedings there were many standing about who offered to climb the tree and drive Goldie into her enclosure. Many were the witticisms, but somehow no one got around to climbing that tree but Goldie and the little bears.

Up the river came a loud boat whistle, warning us that the descent of the Five Thousand was imminent. It was our successful plan to keep the bears in their temporary pen until the boat left the Park in the late afternoon. There were policemen about to shoo children away in the meantime. The day wore on, and the cubs curled up in the tree and went to sleep—the quiet before the storm.

When the children had all departed, we commenced the capture attempts. We endeavored to lure Goldie into the cage so we could drop the gate behind her. We placed juicy meat, covered with honey, (long before this war!) in the opposite end of the traveling cage, in hopes that the big bruin would be hungry enough to go after it. We should have known better. We were not as well acquainted with Goldie then as we are now. She is a smart bear. As some one hundred people watched, she cautiously descended from her perch and then rushed at one side of her enclosure. Men stationed with baseball bats stood their ground and beat upon the wire vigorously. She desisted and glared about, apparently wondering what method to adopt next. If she had only known, she could have scaled that flimsily supported fence in a trace, burst through the men and so away. But the cubs were there, and where the cubs were there was Goldie. At no time during the entire event did anyone think of harming her. Our only aim was to capture the bear without injury to her or to ourselves, and we took far greater chances than she did!

Things quieted down after awhile, and with many false starts and alarms, the cubs finally came out of the tree. Soon they were at home upon the ground, and they discovered the



▲ WHEN the playful cubs emerged, the children always shrieked with delight

cage with the luscious meat. One of them entered beneath the gate, smelled the bait tentatively, licked the honey for a moment, and then quickly hooked the meat with a clever forepaw and drew it from the trap. It was the mother we were after so we did not drop the door. We could have caught the cubs at any time, as later events proved. The little cub, with its proud possession, approached its mother, and that was that. With one gulp Goldie had the meat and it was gone. The cub looked up at its parent as though to say, "Well, if that isn't gratitude for you!" The crowd howled, but howling didn't help to catch bears!

All sorts of experiments were tried to encourage Goldie to enter the cage peaceably, but to no avail. Darkness came and electricians strung light wires over to the temporary bear arena. Then we decided that the only thing to do was to rope Goldie by the leg, place one end of the rope through the bars at the opposite end of the cage, pull her in, and drop the gate. It seemed like a good idea, but it was midnight before it worked.

Time after time the agile Goldie slipped the rope from her glossy, beautiful fur. She pulled it over her head, shook it from her legs, wiggled it off her hind quarters, and otherwise behaved like the champion of all the greased pigs in creation. And how the free advice came pouring in during all of this really hard work! "Get

a fish pole," one man said. "Place the noose over the end of the pole and you can put the rope where you want it." We secured a long bamboo fish pole, placed the rope upon it (for it did seem a good idea at the time), and gingerly lowered it toward Goldie's head. With one stroke she reached up, grasped the pole, and utterly shattered it. Never did a fish pole lose its identity in so short a space of time.

At last one of the men who had been working like a trojan took the rope and tied a hangman's noose, about the only kind of knot we had not employed. A la cowboy he slung the rope above his head and over the fence. It settled over Goldie's neck and shoulders as many a noose had landed before. It slipped down her body as she ran through it, but her left hind foot somehow became tangled long enough for us to tighten the noose. Instantly the men holding the long pulling rope commenced to strain, not permitting any slack. The rope had been placed through pulleys to assist with this. Slowly at first and then with a rush Goldie was hauled into the cage and the door was dropped. The noose was removed and there she was, a very startled, angry bear.

Right here is where the real excitement of the evening commenced. There were still the two cubs to be considered and very much considered. They ran about wildly and for



▲ THEY look alike, but individuality asserted itself at a very early age

some reason, known only to themselves, failed to climb the tree. Two of our most agile men led the chase for them. In the process someone tripped over the light wire. The two bawling, frightened cubs dashed about in the night and we were plunged into inky blackness. Suddenly a yell went up, for as a cub dashed through his legs, a man grasped it by the scruff of the neck. "I've got one," he cried, and then, a moment later, "No, he's got me!" Then flashlights were turned on and the cubs were soon in their box. The mother was returned to the enclosure, the cubs traveled along with us, and the night's venture was over.

We now have a far more efficient method of removing the cubs from the enclosure, one which involves openings in the side wall, portable cages, and a system whereby the mother is temporarily isolated while the cubs are picked up. As far as we are able to determine, it is foolproof

but we never know, for bears will be bears.

Once the cubs are rescued, we are fully responsible for their wellbeing, growth, and to a certain extent, their deportment. The first and most vital step is the transfer from mother to nursing bottle. Sometimes this is accomplished with ease and, on other occasions the cub will fight the bottle as though it were a mortal enemy. Eventually, however, all learn that the source of supply will only come to them via the rubber nipple. We prepare regular formulas and vary the diet from time to time until the young ones are able to depend upon solid food.

When the bottle is known and fully accepted, the cubs rush for it as though they were fully aware that their lives depended upon the contents. Great is the excitement as they grasp the nipple and refuse to let go for one single instant until convinced that not a drop of milk remains.

Their table manners could not be worse, for should one cub finish a moment before his neighbor, a fight usually ensues. They also offer to wrestle the person who holds the bottle if any mechanical failure slows the flow of milk. Often we feed them small amounts many times a day and far into the night. On more than one occasion, when a cub proved particularly weak, small, and helpless, we have taken it into the bedroom at night and set the alarm to ring so we might arise and feed the infant at various times during the hours of darkness. Incidentally, bottles and nipples were always sterilized.

The reward for all of this effort is great. Friendly bear cubs offer much amusement. They will play by the hour, ride about in one's arms or upon one's shoulders with real indications of enjoyment. No two cubs we have raised have been alike in "personality," and by no means could all of them be trusted, for they would sometimes become unpleasant and unsafe. The truly tame individual, which could be more or less relied upon to do what was expected of him, was the rare one in any litter.

Black bears, young and old, often have a disconcerting and misleading way about them. One moment they may be all sweetness and light and the next, for no apparent reason whatsoever, they may become wild and unfriendly. For safety's sake the hand that raises them cannot always be too gentle, for they are quick to take advantage of a person who either fears them or provides them with too great leeway. Undue familiarity may easily breed contempt. There was Brownie, a fine looking little bear with a keen nose, two perky, tufted ears, and the most disarming facial "expression" one could hope for—a veritable child's teddy bear in appearance but in appearance only. When one's back was turned, even for an instant, he liked nothing better than providing profits for some unknown clothier by making it necessary for one to purchase a new pair of breeches. His sharp teeth would rend the cloth in an instant, and black and blue marks would remain where the teeth had pinched.

He would also display his Jekyll and Hyde disposition by sitting benignly upon his log as one entered his cage and then flying into a tantrum the moment he was closely ap-

proached. When chastised his lower lip would be projected in belligerent fashion and he would "talk back" like a terribly spoiled child. He pestered his far more docile cagemate constantly, driving her about, attempting to steal her food, and generally making life miserable for her. One day she turned upon him, and a terrific bear fight ensued which we were unable to interrupt. The outcome was that Brownie became a somewhat meek little bear, for he was thoroughly trounced, and, thereafter it was he who broke and ran whenever the arguments became too strenuous for comfort.

Children never tire of watching the antics of bear cubs. The furry small animals are very attractive when they play and dash about. They



love water, turn somersaults in their pool, and stage regular boxing matches with a rubber hose, turned on full and lowered into the cage from above. Of course, they are great wrestlers and are ever fond of the game, "You chase me and I'll chase you." Up and down, round and about they go, hurdling obstacles, climbing their little tree, scaling the wire, constantly rushing, until they drop with exhaustion and lie upon the cool floor of their enclosure, panting and spread-eagled. A small stream of water flows constantly through their quarters and this, together with the pool, is a favorite resting place on warm summer days.

BEAR MOUNTAIN BEARS

Not far from the cub's rearing cage is a very large playfield, where thousands of people congregate on Sunday afternoons, to enjoy field sports, to picnic, and just to relax. It seemed we could give pleasure to a large number of people by bringing the cubs over to the field for a short time once a week. Accordingly, we arranged a roped arena, brought some other animals and some tame birds as well, and staged a little educational "show." Many hundreds of persons learned about the animals in this way, persons who might well have failed to see the bears otherwise. Needless to say, the cubs were always the star attractions at all of these gatherings, where some two thousand people watched from bleacher seats. It was a performance designed to bring nature to the people as well as the people to nature, and it worked, with the aid of a public address system.

We would conceal the cubs in a large carrying cage, under a shady awning, until the very last. Then we would release the fastening on the box. The cubs would cautiously raise the lid, peer at the spectators, and slowly emerge into full view. Their very appearance made the children shriek with delight, and this alone was worth all the trouble we had taken. Nursing bottles would promptly be brought forth and the cubs would fall to with a vengeance, to the further delight of the crowd and themselves. Somehow we did not care to place collars upon the little

actors, for we disliked to create any impression of trained animals or of bears that had to be restrained in any artificial fashion of this sort. We regretted the absence of collars once, however.

Little Meg, a particularly winsome black bear, daughter of Elsie, carried on with her bottle and seemed really interested in the crowd, when the unexpected happened. She suddenly decided the arena was no place for her. Quick as a flash she darted away from her handler and bolted straight for the people. Her very dash frightened her further. There she was, a thoroughly panic-stricken little cub, approaching the low rope which separated her from the now startled crowd. As luck would have it, she chose to make her bid for escape in a corner of the arena where an amply proportioned woman stood watching the performance.

Run as fast as we could we did not overtake the cub until it had scrambled up the woman's facade and had perched upon her shoulder, clasping her neck with two trembling, hairy forepaws. We retrieved the cub and prepared to care for the woman, who, to our joy, remained smiling and stated that while she was slightly shaken by the experience, she would, nevertheless, treasure her adventure and would enjoy telling her friends about it for years to come. "Not every woman could have been selected out of a large crowd to be hugged by a bear," she said. We agreed. In fact, we would have agreed with anything,

◀ FEEDINGS were frequent, and the nipples were always sterilized

▼ "Let's get this over with. We want to play"



so great was our relief to find the woman uninjured. For while the cub had not the slightest intention of doing any bodily harm, it did have sharp little claws.

It is wonderful to behold how people will criticize one after an affair of this sort has taken place. The critics are usually those who have confined their wild animal handling to pussy cats and white mice. Of course, we were in the wrong. But we learned something, so did the cub, and so did the woman. Yes, during exhibitions we now use harnesses upon our bear cubs whether we like it or not.

Once we had a radio series, presenting various birds and animals, "in person," to a coast to coast audience over the network of a large broadcasting service. Each week we journeyed some 50 miles with birds, animals, and reptiles, and encouraged them to make sounds, on cue. And they all proved good actors. As a finale to the series we determined to build a program around the then reigning bear cubs of the year. When the day came, we placed the two mildly interested bears in a large, comfortable cage upon the rear seat of our sedan car and journeyed through the countryside and down the canyons of Manhattan toward the studio.

It was our misfortune to commit the crime of absent-mindedly traveling the wrong way on a one way street. We probably had bears and broadcast on our minds at the time, and we progressed half way down the block before realizing our mistake. It seemed the only thing to do was to go ahead and hope for the best. At the next street intersection, however, there stood one of New York's officers of the law, bright in his patrolman's uniform with the brass buttons. "Stop!" he said, "and where do you think you're going?" He was not a very original policeman, but when he peered through the rear window of the car and met the glance of two well grown bear cubs, he stepped back a pace, raised his hand and motioned us to proceed. "I don't know what you've got there," he said, "but the main thing is, get 'em out of here!"

Soon we had the uncollared cubs in the large studio, where the announcer and producer immediately expressed their envy of the sound technicians, who grinned at us

from their place of safety behind a large panel of plate glass. A separate microphone was provided for the exclusive use of the cubs and their handlers. We opened the door of the cage and permitted the bears to roam about the sound-proofed room, for we believed this would make them more at home when their turn came to address their public.

The program started off very well and several pages of the script had been read when one of the cubs spied the imposing grand piano in a corner of the room. He climbed up on the bench and was about to bring both forepaws down upon the keys when he was speedily removed. This quick, unexpected action on the part of his handler alarmed him, and he commenced a wild dash about the studio, under the piano, through rows of seats, and finally against the legs of the now perspiring performers at the microphone. Every second that ticked by brought the time nearer when our aroused ursine companion was supposed to participate in the program.

A flying tackle brought the bear to earth, not without strenuous vocal objections on his part. The other bear had become excited by the commotion and raised his voice in protest. Milk bottles were hastily proffered, and both cubs at once were calmed as they drank lustily, forgetting all former uneasiness. The trouble was that the milk was gone before the time came for the animals to be placed in front of the microphone. When the now unnerved producer indicated by pointed finger that only a few seconds remained before the cubs were to go on the air, their handlers, of necessity, grasped the animals by scruff of neck instead of calmly leading them with the bottles. Thus, as their air time came, the struggling young bears were unceremoniously placed before the microphone and their loud complaints went out over the nation on schedule but not as planned. Instead of the contented throaty noises uttered when being fed, the air was filled with angry roars and raucous bellowings.

The entire program lasted only fifteen minutes, but the cubs had given us some anxious moments and we were not at all unhappy when we heard an announcer in another studio, as he introduced the next program, saying, "Now ladies and gentlemen, we present a few quiet moments of

music to soothe the nerves jangled by the hustle and bustle of everyday living." Things like, that linger in the memory. The day was over and we returned the disgraced radio actors to their Bear Mountain home, without further incident.

In the early spring, when it is too cold to place the cubs in their out-of-door cage, we keep them in our Trailside Museum animal building where their immediate neighbors are some very tame woodchucks, skunks, mice, squirrels, and others. On opening the door each morning we are greeted by cries from the cubs as they demand their first feeding of the day in no uncertain tones. One morning, however, we unlocked the outer door as usual and found things inside were not as they should be. The cubs were curled up in their small cage, fast asleep, with the door of the cage wide open. The room was a shambles.

It soon became apparent that the cubs were tired out after a night of roistering. The skunk cage had been invaded and its door hung open crazily on one hinge, yet the occupant was also asleep, and, though all his weapons were present, he had not perfumed the air, all of which constitutes some sort of miracle in itself. The chipmunk cage was empty and the wire screening upon its top was caved in where one of the cubs had sat on it. And, wonder of wonders, the windows were open, yet the cubs stayed with us. It was barely possible that someone failed to fasten the cub's cage properly, thus providing for their escape. We could not be certain and, of course, the cubs had no clue to offer.

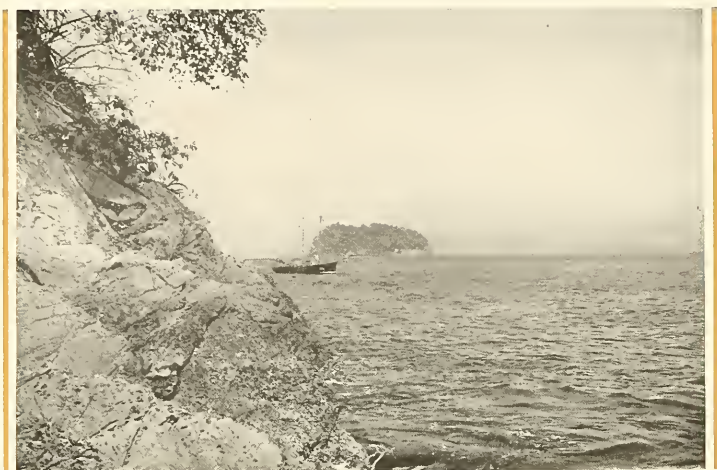
All in all, we have had a great many guessing contests with our cubs and somehow they rarely come out second best. Of course, we repaired the cages and cleaned up the mess, and the cubs were fed as usual when they awoke and yawned unpolitely in our faces. A new day had dawned for them and the night was forgotten, but not by us.

Whatever the depredations caused by our bears, large or small, we always regret the day when, for any reason whatsoever, we find it necessary to send one away. We have shipped them to widely separated places from New York City Zoos to the Pretoria Zoo in South Africa. No matter what they do, we like them just the same.

Beyond the Continental Shelf

By ROBERT CUSHMAN MURPHY

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▲ THE SCHOONER "ASKOY" dredging under power just outside Piñas Bay, southern Panama. In the foreground is the Morro de Piñas and behind the

vessel, or to the north, the Morro Centinela. These two rocky and heavily forested islets mark the entrance of the broad and deep harbor

FROM Piñas Bay, near the southern boundary of the Republic of Panama, we set sail due west on the morning of February 26, 1941. Our object was to investigate the perennially warm ocean water and its life off soundings in the open Pacific. Our first landfall was to be the light on Point Mala, a hundred miles across the broad mouth of the Gulf of Panama.

Mantas were flopping from and into the ocean with lively splashes when "Askoy" entered the blue-green Pacific from the turbid water of Piñas Bay, which receives the run-off of the Baudó mountain wall. Farther from shore North American black terns—not then black, but gray in their winter plumage—were darting in flocks from one center of fish concentration to another. Their alert movements were the Pied Piper charm that pulled a train of laughing-gulls, petrels, boobies, man-o'-war birds, and even a Galápagos albatross, in their wake. Toward the same focus rolled the ever-leisurely, undulant pot-head whales, or blackfish, to complete the chain of carnage and subsistence that runs, link by link, from nutrient ion to diatom to crablet to

A typical cycle of events aboard the exploration schooner "Askoy," recounting the daily adventures that lure men "down to the sea in ships," to fathom mysteries of the deep

little fish to squid to skipjack to bird or whale, with sundry short-circuitings along the way. Such is the house-that-Jack-built in the sea. Like a merry-go-round whirled the frantic, chattering terns above backs that were finny or blubbery or feathered. The birds stooped close to the surface but never dived, in the process of capturing their prey. Then, when the ocean suddenly swallowed the source of all the rioting, the rings of terns broke rank and whisked away a mile to fresh repasts.

We were not long to enjoy such detached consideration of the activities of other beings. Offshore, visibility became poor and a wind from west of north increased throughout the day. By evening it was blowing half a gale. During the night we progressively shortened canvas, not so much from necessity of ship-handling as to keep "Askoy" from overrunning the station to be worked at dawn.

Regardless of seamanlike planning, a small craft new-laden with special-

ized gear requires the shakedown of rough weather before she can be regarded as well stowed. Our first fortnight at sea had been merely a halcyon jaunt. Of the six men then on board, only two were veterans of "Askoy's" four-year span. New winches on deck, bulky lockers of nets and dredges, the racks for instruments and containers above and below, produced a congestion hitherto unknown in the little schooner's career. The first test, not without its minor casualties, came during the black and windy hours of this seventeenth day out of Balboa, while "Askoy" pitched and twisted, creaked and banged. Only two of us acknowledged a few fitful cat naps, to the envy of the others.

The first segment of the sun showed as we began our labors at a position fixed as early as the horizon had become a clear line, and checked later by both log and sun-sights. A worse deck to work on I had never seen. Hove to, we were wallowing scup-

pers under, the teak awash except at bow and quarterdeck. The swell was choppy, with every second wave breaking. Getting about proved an apelike process of brachiating, the forward hand grasping structure or stay before the hinder dared let go. Working the winches was a galley slave's task, especially because we were now sending ponderous weights and water-bottles down farther than heretofore, to match the greater depths beyond the continental platform. It was three hours before we could breakfast. When I finally swung down the companionway, two of my shipmates were holding porridge bowls before their faces at an apparent angle of thirty-five degrees while the schooner heeled. Milk, it seemed, spilled in the cabin only when it looked level.

We spent three days completing stations 22 to 28 of this first section westward from the coast, and during much of the period we were on our beam ends. Experience taught us to expect the nights of the north-wind season to be blustier than the daylight hours, and two of our most laborious stations had to be worked in the dark. The night of March 1st dealt us our worst beating; from the brief equatorial twilight until the wind slackened at sunrise we churned in steep combers. Heat below decks was even more to be dreaded than drenching, so the floor of my after-cabin was slithery with water from the open skylight. At the stroke of twelve, in the mate's watch, I was on deck. The wheel was lashed, and duty called chiefly for a sharp lookout from a post sheltered enough for safety. It was close to that moment that the biggest wave of all four months afloat

struck us broadside and washed clean over, which meant nothing worse than an unduly boisterous showerbath to a man whose fingers were squeezed bloodless round the lee shrouds.

At the close of this same day, with the red coals of the afterglow astern, we sounded our cautious way back to an anchorage near the head of Piñas Bay. The crest of purple-black mountains, which looked almost within arm's reach, cut high across the fore-stays. Skipper and crew smiled approvingly when I said that we would lie here for two long sleepy nights, with nothing but African drums, which never cease in the black man's village of Santa Dorotea, to disturb our dreams.

The Daily Grind

"Six days shalt thou labor and
do all that thou art able,
And on the seventh, holystone
the deck and scrape the cable."

Our toil of six days, however, proceeded unchanged on the seventh, so long as we were at sea. Moreover, we possessed no holystone, but when we entered the zone of rains we found, alas, that the sun-baked deck needed a prodigious amount of caulking.

In order to picture our doings at 113 localities afloat, let us consider the routine at Station 36, which we worked in easy weather on a Sunday in March, 60 miles west of Point San Francisco Solano, Colombia, at the seaward tip of one of our transects. The site lay, we had every reason to believe, within a circle of two-mile radius around a point pricked in advance on the chart.

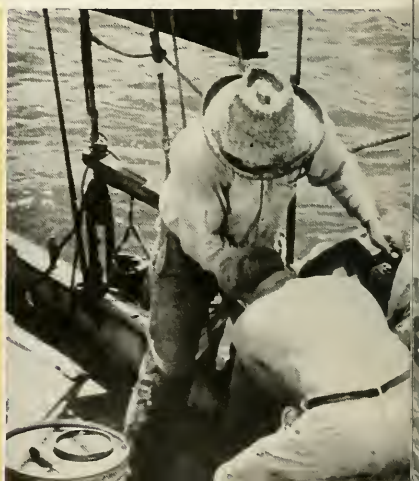
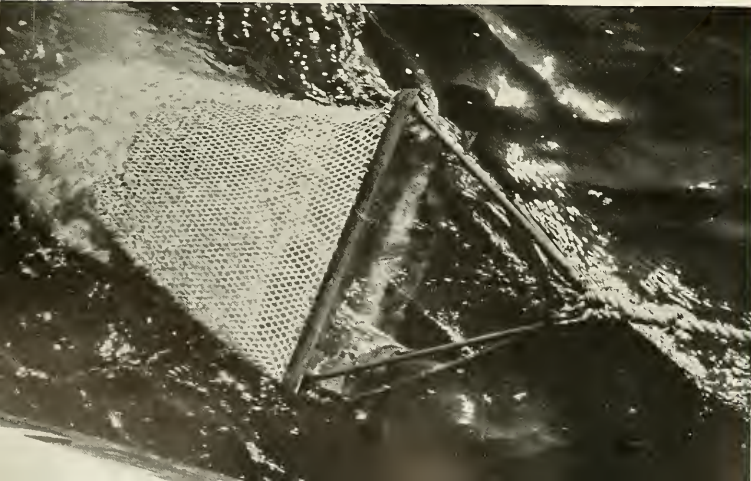
Confidence in the exactitude of each position took an upward trend after

the first call at Buenaventura, where Eduardo Fallon, of the Colombian Navy, became his government's representative on the expedition. Comandante Fallon had a multiple function, part of which was stated and the rest politely understood. He was to observe and take part in oceanographic technique that might have a useful bearing upon his own future hydrographic or tactical practice. He was also to be an appropriate companion for foreign and wholly unofficial investigators to whom Colombia had extended generous, or even unprecedented, privileges.

No one could have filled the purpose with more forthrightness and tact. Young and whimsical, lean and lithe, Fallon forsook his luxurious gunboat, where a crew of 30 had no thought but to please him, and joined our cramped, hard-bitten, often uncomfortable group with an enthusiasm that never lagged. Day or night, he was rarely below deck except at mess. He emphasized the pleasure, rather than the duty, of his orders. "Gentlemen," he would announce, while tossing a banana peel into the deep, "my sole concern is to warrant that your expedition jettisons no garbage in my country's sphere of the Pacific!" But, between sharing in countless more practicable responsibilities, he lived with his sextant in hand, never missing the morning and evening pairs of navigational stars when a horizon

▼ THE CONTENTS of a small dredge are emptied into white enameled tanks and pans on deck. Only after much sluicing with a hose and a careful picking over with spoons and tweezers will the mud yield its treasure of small fishes, worms, sea urchins, mollusks, and a large variety of bottom-living crustaceans

▼ UP COMES THE GREAT DREDGE, gravid with its load of gray-green sandy mud



could be discerned, and plotting equal altitudes at midday as well as a half dozen additional position lines during the sun's course.

It took Fallon, moreover, to show us that at least a portion of our former uncertainties had been due to the presence of a stowaway on "Askoy." Immediately after coming on board, the *comandante* began the painstaking process of rating our chronometers. He soon decided that the queer one of the pair, which exhibited a tendency to gain one day and lose the next, deserved an inspection of its inner sanctum. And there, disporting among the wheels, he found a lively yellow ant, a prisoner for at least six weeks, feeding presumably upon the film of porpoise-jaw oil that lubricated the bearings!

To return, now, to Station 36. About half past three o'clock on the afternoon of March 9th, we estimated on the basis of dead reckoning from the latest fix that we had arrived at our goal. Sailing Master Halford



▲ LAUGHING GULLS from North America in their winter plumage, which lacks the black head. This species, like the black tern, winters abundantly along the warm Chocó seacoasts



Drawn by F. L. Jaques

◀ A SKETCH of a large company of North American black terns, in winter plumage, forming a characteristic merry-go-round over a school of fish off Point Marzo, Colombia



Connolly, who hailed from Grand Cayman of the Indies, ordered the motor stopped and brought the schooner up into the breeze under short sail. The position, date, time, the state of wind, weather, clouds and sea, the temperature of air and ocean surface (as close to a tenth of a centigrade degree as we could reckon), the depth beneath our craft, and the reading of the taffrail log as sung out by the mate from the stern, were then recorded on a new page of our station book.

The bathythermograph, which has the form and vanes of a slender, in-

verted bomb, was taken by John Armstrong from its rack in the laboratory and passed up through the hatch. Doctor (now Lieutenant) Armstrong, a veteran of oceanographic cruises in the Woods Hole ketch "Atlantis" and my scientific colleague on "Askoy," usually made the detail of these recordings, together with the diving and dredging operations, his particular charge.

On deck, I shackled the precious instrument to our smallest steel hydrographic wire, leading from the drum of a sounding winch mounted amidships. The wire was first rove through a bronze meter-wheel suspended from the tip of our working boom, which was stayed so that it projected beyond the bulwarks.

I next put the bathythermograph gingerly overside and Armstrong low-



◀ **BLACK TERN** resting on the rail of "Askoy." The winter range of this bird was unknown until Doctor Murphy's first expedition to the Chocó in 1937. Vast numbers of black terns, which nest in the northern United States and in Canada, spend the winter over the coastal waters between Panama and the Gulf of Guayaquil



▲ **OSCAR PAAR**, engineer of "Askoy" and the best hunter and fisherman on board, is all set to harpoon a porpoise from the bowsprit

➤ **SPOTTED PORPOISES:** frequent companions of the schooner in the warm Chocó waters. Four animals show in this photograph. The young one in the left foreground, still under water, is beginning to spout just before its blow-hole breaks the surface



ered it from the winch. The time of the plunge, the surface temperature at the moment (an important datum on the subsequent plotting of the slide) and, lastly, the angle of the wire, were noted or measured. We could read directly from our meter-wheel how much wire had gone out, but it descended on this occasion at a 20-degree angle instead of as a plumb line. To control the actual depth of the bathythermograph it was therefore necessary to compute the vertical or imaginary side of the triangle, which required but a moment's reference to the traverse tables of Bowditch as soon as both length and angle of the wire had been read.

Up moved the bathythermograph, as gradually and evenly as it had gone down so that the rate might not outrun its delicate adjustability to changes affecting the temperature and pressure elements of the mechanism. I recorded the exact time at which it left the water. The whole operation on this afternoon had taken 18 minutes, but the task might not be regarded as finished until Armstrong, who had darted down to the laboratory, withdrew the glass plate, and pronounced the tracing satisfactory. After drying, the too easily smudgible slide would be dipped in shellac, and later printed photographically on a paper grid that would enable all depths and temperatures to be precisely correlated. Even the fresh wet

slide itself, however, permitted us to judge approximately the depths of the thermoclines, or levels of abrupt change in temperature of the stratified ocean. Close to these, samples of the sea water and catches of the living organisms might be expected to prove of most significance.

The bathythermograph recording was only the beginning of a process often made wearisome by weather and darkness. Water samples and plankton catches followed in succession. The former were taken with reversing water-bottles, which are brass cylinders mounted in rectangular frames and set with springs, like a trap. The tipping over and closing, far beneath the surface of the ocean, is accomplished by sliding a weight or "messenger" down the wire.

The "plankton-sampler" is an ingenious and strictly quantitative instrument, comprising a net attached to a finned metal cylinder fitted with a circular trap door. Closed samplers are sent down to chosen levels while the ship is moving slowly. They are opened by messengers, and ultimately snapped shut again by the same means. The instant they open, a propeller in the mouth of each is set in motion by the pull, measuring precisely the volume of water that passes through and recording it on a numerical indicator. Simultaneously the net filters out the living organisms and collects them in a terminal brass bucket, the outlet of which is screened by the finest of wire gauze.

As soon as the bathythermograph had been returned to its rack, the slender sounding wire was reeled in from the meter-wheel and a stouter cable with a breaking strength of more than a ton was passed through from one of our two identical heavy winches bolted on the starboard deck. With the object of reducing wire angle and thus lessening the labor of hauls, the end of the cable was weighted with a hundred pounds of lead.

The first bottle, open at both ends and clamped onto the wire as soon as the weights were immersed, cut the surface at 16:19 of our 24-hour time scale. José Correia, veteran New Bedford whaler, who had been my fellow seafarer since a South Atlantic cruise in 1912, took a heroic stance behind the winch. At the signal of an upraised hand, he loosened the brake and the greased cable hummed out. Its departure from vertical was so



▲ TWO OTHER typical views of spotted porpoises. The species is very close to *Prodelphinus plagiodon*, a porpoise common along the edge of the Gulf Stream, ▼ in the Atlantic



▼ SAILING MASTER CONNOLLY at the wheel



ASKOY EXPEDITION 1941

Station No 70		Locality 132 miles S X E of Malpelo Island					Latitude 01° 47' N		Longitude 81° 10' W					
Date March 31	Wind NE 2.5	Sea 2	Swell -		Weather clear		Clouds 6							
Air Temperature 27.50		Surface Temperature 27.70			Depth (from chart) 1760 fathoms									
SAMPLE NO.	ISST	TIME OUT	TIME IN	WIRE L ⁿ	WIRE OUT IN	DEPTH OF OBS. ST.	TEMP. AT SURF.	PS METER NO.	PS METER IN	DEVS.	NET NO. & MESH	INTERVAL	LOG	SALINITY BOTTLE
237	Bathy	0612	--	45	150	106	--	--	--	--	--	--	106.5	--
238	No. 2	0650	--	70	107	100	17.19° (25.13°)	--	--	--	--	--	--	35.03
239	No. 1	0650	--	70	52	50	--	--	--	--	--	--	--	420
240	No. 2	0714	--	70	--	--	25.64° (26.42°)	--	--	--	--	--	--	34.94
241	No. 1	0714	--	70	--	--	--	--	--	--	--	--	--	421
242	No. 1	0718	--	0	--	--	--	--	--	--	--	--	--	34.10
243	50-m. Plankt.	0740	0850	45	--	--	--	--	--	--	4/2	--	--	422
244	No. 3	0745	0846	45	143	100	--	71765	80413	8648	4/2 10m/5'	--	--	--
245	No. 1	0745	0846	45	71	50-3	--	36272	41623	5351	5/2 10m/5'	--	--	--

*G. from barometer *Computed from wire out and G. *Water bottle reversing thermometer *Plankton wispel *Classification of PS meter *Length of wire over outside of ship

slight that only 107 meters of length were called for to reach the 100-meter level. However, the cable was first checked at half length for attachment of the 50-meter bottle. From the latter dangled a messenger, which was snapped over the wire. Later this messenger would be released to skid on downward, trip the reversing gear of the 100-meter bottle, and thus close its rubber-gasketed lids. (It is a house-of-cards process, set off when both bottles or, in deep-sea work, a whole series of bottles have reached the selected levels.) At the right moment another messenger was started on its glide from deck. Within a few seconds, a muffled *pung*, traveling up the cable, indicated that the 50-meter bottle had overturned and sealed its

water sample. A few anxious moments more, and then a fainter signal gave the happy assurance that nothing had fouled, that this time no gadget had gone cantankerous, and that the lower messenger had in turn fulfilled its charge.

Now for the grind! Power for the winches on "Askoy" had its source in what sailors dub "Norwegian steam." I am everlastingly grateful that no member of our team ever sought to be elsewhere when his turn at the crank fell due. On the contrary, a sort of extrovert jealousy was evident, and Comandante Fallon's only signs of annoyance were shown when he suspected that our local strong boy, Oscar Paar, the engineer, had dished him out of a meter's worth of his own

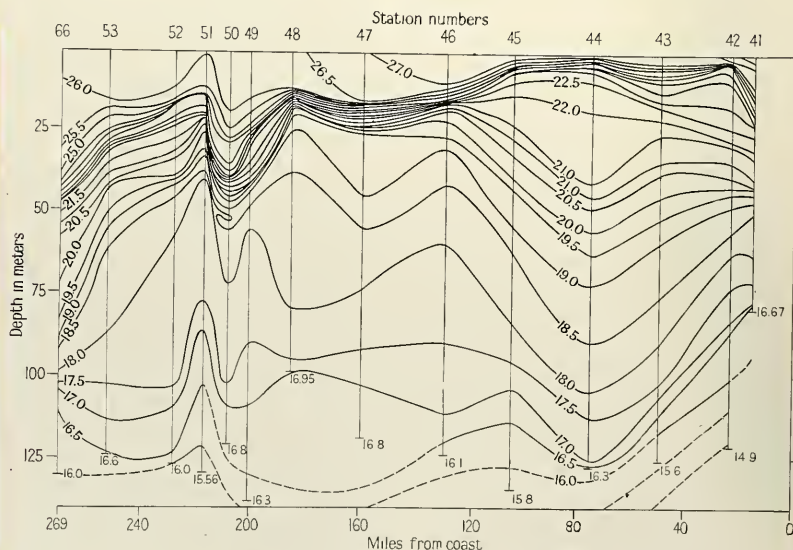
◀ A SAMPLE PAGE from "Askoy's" station log, showing the records entered at Station 70. The abbreviations for apparatus in the instrument column refer to the bathythermograph, five reversing water bottles, a 50-centimeter plankton net, and two plankton samplers. The significance of certain other figures is indicated in the descriptions of daily routine in the text

load. It was a form of arrogance that he would not tolerate!

Robert François, mate, who had shared the forecabin with Oscar ever since "Askoy" was launched at Antwerp in 1937, was first at the winch with his customary battle cry, "*Pour la science!*", for which his shipmates regularly threatened to drown him. He hauled up ten meters of cable and stepped aside. Correia then laid hold, only to be ordered off because we knew that he had sprained his back at Aguacate Bay three days before. Skipper Connolly took his place, to be followed in turn by the leader of the expedition.

When the upper container had been hoisted to the level of the safety rail, a numbered bottle of treated and insoluble glass was first rinsed with water, drained through a petcock from the metal cylinder, and then filled with more of the same water and stoppered. Salinity Bottle 359 thus became the 50-meter sample from the station, and subsequent analysis showed that it contained 34.79 parts

➤ A TEMPERATURE SECTION of the sea extending from near Buenaventura to the vicinity of Malpelo Island. The diagram shows how layers of ocean water of different densities can be plotted from subsurface temperature records. The lines of equal temperature are noted in centigrade degrees. It should be remembered, of course, that the vertical scale is vastly exaggerated, in comparison with the horizontal scale, which embraces 269 miles. The figures at the top are "Askoy" station numbers



of ocean salts in each thousand parts of water. The next series of hoists brought up the 100-meter sample, which shot out its stream under higher pressure and which later proved considerably saltier than the other. Furthermore, its attached reversing thermometer showed that the water of the 100-meter layer had a temperature of only 16.5°C . (61.7°F .), instead of the 27.5°C . (81.5°F .) of the tropical surface. We repeated the rigmarole for lesser depths, using the pair of reversing bottles for samples from 25 and 10 meters and the surface.

Lastly came our nets, which were attached to the same heavily weighted wire. Since nets must move forward in order to fish, the schooner needed at least a slight headway. The half-speed of "Askoy" was too fast to be satisfactory, for the reason that it produced a high wire angle and multiplied the toil of hauling in. When we could head under power against wind and sea, or use sail alone in a very light breeze, all was well. Otherwise it was necessary to circle, which meant that the cable tended to circumscribe a cone and the lowered nets were thus geared down to trace shorter and slower rings than the one made by the schooner at the surface.

At Station 36 our sampler nets were of No. 2 mesh (54 meshes to the inch), designed to intercept organisms as small as copepods, but not the vastly tinier plant forms known as diatoms. We fished two of the nets in ten-meter stages through vertical distances of 50 meters, the lower instrument rising while open from the 100-meter to the 50-meter level, the upper from the 50-meter level to the surface. After each 10-meter lift, the workers at the winch had a rest until a five-minute alarm clock recalled them to their punishment.

Into the columns of the station book went the usual data, such as time out, time in, and wire angle.



▲ DOCTOR ARMSTRONG releasing wire from the forward winch so that the instruments may descend to selected levels. Behind him stand François and Correia, ready for their spells of hoisting

Furthermore, it was reported that plankton-sampler No. 3 descended with its meter reading at 30,613, and was closed 45 minutes later, at 35,894. Its catch, ultimately to be interpreted as so many hundred thousand organisms per unit of ocean water, was for the moment preserved in a glass jar which, before the lethal formalin was added, made a spectacle in the sunlight that was gorgeous beyond description. In a living soup of organisms too small for perception by man's unaided sight, were throbbing hosts of copepods and other crustaceans, ctenophores, marine worms, embryonic stages of mollusks, and larval fishes. But most of all, the microcosm seemed a pool of a million accusing eyes, all pigmented far more strongly than the bodies of their owners, all flashing every hue of the spectrum, like irradiated gems.

And so, when all the gear came aboard, the job at Station 36 was ended, and we could resume our course. But Armstrong, down in the laboratory, was sluicing and decanting and labeling, and busy with bottles and chemicals, until far into the night.



▲ Two views of the plankton sampler: ◀ an incomparable collector of free-swimming organisms of a size between small and microscopic. At the front of the cylinder is a circular trap-door, which is opened and closed by "messengers"—weights sent sliding down the wire. The side fins help to keep the instrument steady and level, and the counter on top records revolutions of the water-measuring wheel. Sea water filters out through the extremely fine silk net, and the quantitative catch is collected in the brass bucket at the end



ACROSS the thick platform of sticks which hung in the top of the great burr oak lay the coon. With his black human-like hands palms, downward over his black-masked face, he lay belly-up in the warm May sun, every muscle rag-limp. He felt so lazy and so secure on his high sun-perch he didn't bother to open even one eye at the zebra woodpecker that came hammering along a dead branch close to his head.

The coon had no connected thought about the matter, but several things contributed to his feeling of ease and security. For one thing, the lean season of March and April had just passed, and his belly was full of frogs gathered from the near-by creek, frogs that were even now being transformed into his own flesh. Also, the abandoned hawk's nest upon which he lay appeared to be just that when seen from below—a dead, unused thing commanding no attention—and the great horned owl, the only big killer in that neighborhood that could come at him, wanted no dealings with a coon of his size.

But most of all, perhaps, his sense of ease and well-being came from the fact that this tree was his own, his home den. Now and then when compelled by circumstances he spent a day in some other tree, but always as quickly as possible he came again to this oak as a long line of ancestral coons had done before him.

Thirty feet below where he lay, the great trunk forked, and in the fork, invisible from the ground, was a hole running deep into the old tree's heart. Here the coon had slept through the cold months of his first winter but lately passed; here, too, in its shadowy depths, he spent most of his daylight hours (the sunbath such as he now was taking was limited to an hour or so of a morning and only on bright days). Here, also, he had been born.

The coon weighed nearly 20 pounds, perhaps a quarter less than when a few months later, surfeited with food, and with skin heavily lined with fat he would begin his second sleep across the time of winter. The vital, rugged, 20-pound ensemble of bone and muscle that now was his body, looked little like the blind, naked, squirming thing that had been his beginning the year before. And still less did that quarter-pound squirm, resemble what he had been some 63 days before that. For

The Way

A.M.N.H. photo

then, at life's inception, he had been an almost invisible speck of his mother's flesh, a globule of life potentially a coon, a globule which first loosened itself from the mother's ovary, and then after meeting and joining with a still smaller bit from the father's body, had fastened itself as a parasite upon the inside of her womb. Thenceforth for nine weeks, by a marvelous alchemy unknown to her senses, his mother had molded and fed this tiny blob of flesh, fed it by way of her blood upon the transformed substances of wild things—of frogs and fishes and insects and fruits she had eaten—fed it until it had at last become himself, a coon.

His first days had been blind and almost insensate, passed in periods of heavy sleep interspersed with short periods of wriggling and whimpering and sucking, all this mingled with the taste and smell of milk and the feel of warm hair and moving bodies. Then had come a sense of light, and of the use of muscles, and of climbing, and the feel of rough bark under paw and belly, a gradual change from milk diet to raw flesh and solid materials generally, and delicious relaxation in the warm sun such as he was enjoying now.

From the two tiny germ cells that had gone into his beginning, the coon had inherited all the general qualities of coonness: a thick, bearlike body, heavy, black-ringed tail, sharp nose, ears held wide like a cat's, black feet which left tracks in the mud almost as if a barefooted baby had made them, and a mouthful of wonderful teeth. With these purely physical qualities had come also a raw strength and courage that made him fear no animal his size, an insatiable desire to smell and particularly to feel all the small tangible objects of his environment, and an appetite that desired and accepted almost anything edible.

As with all coons, he had learned from his mother where the good things of the palate were to be found and how to gather them. For she had led him on nightly trips into the woods

A true-to-life story recounting the seasonal activities of a raccoon that found himself alone in the world

and fields and had taught by example the ways of mouse-trailing and frog-catching, the unearthing of insect larvae and turtle eggs, where to find wild grapes and green corn, and the meanings of smells and feels and sounds and sights. What she did, he did as best he could; the pattern of her behavior impressed itself into his nervous system and became his own, improving, of course, with every repetition of his actions.

Also from his mother he had learned that there were dangers in life, things to be feared and kept away from. Once when they were hunting, there had come a soft whirring from the air above and a quick shadow across the moon. His mother had leaped and snarled at the thing, but—one of his brothers was no longer there. The incident came to mean danger from the skies, horned owl or hawk. Once, too, there had been distant yelping sounds to which his mother had quickly responded by leading him and the rest back to the home den though they were scarcely started on the night's foray. These sounds, he learned, meant hounds.

Not all noises were to be feared, however. There were, for example, the meaningful but welcome sounds of a frog's leap into the water, the squeak of a field mouse in its nest, the borings of insects in stumps and logs, and the friendly calls of the whippoorwills and screech owls.

All of this learning process had come in the summer of the preceding year. In accordance with the best coon tradition, he had denned up with his mother and the rest of the family for the coldest weather. But by early spring, driven by hunger and the re-



of a Coon

productive urge, they had begun to sally forth, and since either by accident or intent one after another of the family failed to return, he finally found himself alone as master of the home tree.

The pattern of the coon's days was determined largely by weather and season. During late February, fresh from his winter's sleep, he had been lean and ravenous, for the nights were long and cold, and the earth and waters frozen. Food of any sort was hard to get, and in consequence his ribs showed through even his heavy fur. His feet, too, were usually wet and numbed, and most of the hours not spent in foraging were drowsed away in the damp, shivering discomfort of his den.

But for all the coon's misery and lack of food at this period, there was yet another hunger—one more urgent than the call of his stomach—the hunger for a mate and a family. On one of his late February prowlings he found a mate and led her here to his tree, but no family came of this first "marriage." For the female, shortly before her time, unwittingly thrust her foot through a hole in the ice which concealed a mink trap, and he had finally fled in terror at this nameless thing that held her.

And now with both the mating-

moon and the lean season passed, the coon promptly forgot his sufferings and gave himself unreservedly to a life of ease and satiety. He was at once both gourmand and epicure, for everything that a coon fancied was around him: the air drowsed with insects; tadpoles and frogs and fishes swarmed in the ponds and shallows; bird's eggs and young mice were to be had for the gathering.

Hence for the next several months, each cycle of the sun was much like another, a succession of joyful hunts, a stalking and a capturing and a feasting. Each night he sallied forth eagerly on a mile-long, more or less circular path, starting at the home den and usually ending there before dawn.

The coon was peculiarly and wonderfully equipped for these nightly predations. For one thing, his forty teeth could handle a wide variety of foods. Superficially, they appeared much like those of a dog or a wolf and could inflict an equally terrible wound in battle. He had the same four long, piercing, tearing canines in front, but his back or molar teeth were very different, for they overlapped the lower ones only slightly at their outer edges, leaving the rest of each tooth to meet the others in a broad grinding surface. Thus the coon could eat flesh and grain and fruit.

But it was at his frog-hunting that he best exhibited the one sense that set him off sharply from every wild hunter about him. Foxes and badgers and wolves and minks might equal him in special armaments of tooth and claw and in keenness of eye and ear and nose, but none could compare with him in the use of his front feet. For they were not merely something

to walk on as with the other beasts, but real hands as well, hands so amazingly sensitive they appeared to be extensions, as it were, of his other senses. When a frog splashed into the black water and buried itself in the yet blacker mud at the bottom, it was invisible of course to his eyes but not to his fingers. Gently, delicately as a snake's tongue, his probing fingers read the braille of the creek's bottom. Contact was made with the victim's cold hide, and before the creature could shrink away it was clutched in a wirelike grip—a response so rapid it was as if the coon's fingers knew what was to be captured without any communication with his brain.

So night after night during the summer and early fall, he waded in the shallows, poked crayfishes from between rocks, raked grubs from old logs, and prowled through the tree-tops for bird's eggs and nestlings. He walked the full length of every fallen tree in his path, examined every bright or unusual object, thrust his paws into endless crannies, and true to the fashion of all coons, never ate flesh without first washing it. As he prowled the night, he stopped often and listened to its many and varied voices, his brain telling him with uncanny accuracy the meaning of each and the response called for. Now and then on particularly black, quiet nights, he would cease a moment from his hunting and send forth his "whicker" or song—a long, drawn-out "whoo-oo-oo-oo," a call perhaps harsher in quality but very much like that of a screech owl, and with a meaning known only to a coon.

But as summer waned into fall and the nights cooled and lengthened, changes both physical and mental came slowly upon the coon. His coat, which had become somewhat thin and faded, gradually fell from him and was replaced by a finer, thicker, and more lustrous one. His desire for food, always strong, seemed even to increase as the year shortened. In August he had fairly gorged himself for two weeks upon green corn, often returning to his den of a morning so full of the milky kernels he could scarcely climb. When this delicacy had passed, he added many pounds of wild grapes to a menu already overloaded with an abnormal catch of half-frozen grasshoppers, and mice and frogs—themselves laden with a food reserve against winter.

Hence, in consequence of his glut-

Continued on page 336

A.M.N.H. photo



The origin of the AMERICAN

By CLARK WISSLER

*Curator Emeritus, Department of Anthropology,
The American Museum of Natural History*

Piece by piece, scientific archaeology fits together the story of primitive man's early migration to the New World

THE rapidity with which European colonists spread over North and South America is the astonishing incident in our history. Columbus unintentionally started one of the World's greatest "gold rushes." The boosters of the time circulated stories of golden cities, walled with precious stones, of "gilded men," fountains of youth, hoards of spices, and fine furs for the taking. Read Adolph Bandelier's forgotten but thrilling book, *The Gilded Man*

(1893), for an understanding of the spirit of the 16th century. In later years the appeal was to the farmers of Europe, through promises of "free land" yielding riches without end. The response to all these lures was one of the greatest of human migrations, reaching its maximum about 1900—a rising tide of Europeans seeking a better life in the New

World. During these four centuries (1500-1900), migration and natural increase brought to North and South America a population estimated to exceed 170,000,000, which in another 40 years reached a total of 270,000,000. Future historians will doubtless comment upon this as the great migration of the white race which spread over the New World.

The American Indian shows certain basic resemblances to



A PAPAGO INDIAN. Compare cheek bones and nose with Mongolian below



AN ASSINIBOINE WOMAN. Note eyelids and nose



A Lama of Mongolia

A.M.N.H. photographs



A Mongol Woman

INDIAN

Yet long before occurred another migration which, too, overran the whole of North and South America. We cannot date this migration in terms of our calendar, but the sciences of geology and paleontology have set up a time calendar, using changes in climate, animal and plant life to mark off successive time periods instead of years. The two latest periods in this scale are Recent Time, in which we live, and Pleistocene Time, the period immediately preceding it. Recent Time in America begins with the vanishing of the mammoth, mastodon, prehistoric horse, camel, giant



By A. A. Jansson under supervision of Barnum Brown

▲ A HERD of extinct bison near the present location of Folsom, New Mexico, hunted by early inhabitants of North America, as reconstructed from scientific evidence. A volcano, now extinct, had dammed up the stream by a lava dike

Asiatic peoples



AN APACHE MAN. Compare eyes and face form

sloth, a buffalo (*Bison antiquus taylori*), etc. Until about 20 years ago it was correct to say that no satisfactory evidence existed for man in America before these Pleistocene animals became extinct, but now the story is different. We not only know that man hunted these animals in North America but that he had extended his hunting ranges to the extreme southern end of South America before the last of these animals became extinct. In short, the first great migration of Old World peoples to the New can be set down as not only beginning but culminating within the limits of late Pleistocene Time.

Unfortunately this statement raises more new questions than it answers. We should like to know what people made this first great migration? Where did they come from? How many years have passed since this happened? Was this the only great pre-Columbian migration? And so on and on. Some of these questions can be answered with reasonable certainty, as:

1. The first Americans came from Asia through Alaska.
2. They were closely related to the ancestors of the Chinese and other Mongoloid peoples immediately surrounding them.
3. The first wave of migration was during the last of the late Pleistocene period, just before the extinction of

the mammoth, horse, camel, sloth, and *Bison antiquus taylori*.

4. The first pioneers were nomadic hunters. They were ignorant of ships and metals, neither had they domestic plants nor animals. They used fire, but made no pottery. They seem to have made no baskets.

What is the evidence for such positive statements?

The reader may rightly ask how can one know all this about events for which there are no documentary records? In the first place, we feel sure that man originated in the Old World since all the known extinct species of man and near-human species of apes were found in the Old World. No such remains have been found in the New World. The last species of man to become extinct was Neanderthal, or Mousterian man, who evolved a type of tool-using and a hunting way of life, characteristic of the long Mousterian period (20,000 years) of the Old Stone Age.¹ Mousterian Man is sometimes spoken of as "gorilla faced" because he had a low forehead, heavy eye-brow ridges, and a receding chin. Yet he did not look exactly like a gorilla—far from it, he was human.

¹ A chart showing the position of the Mousterian period in the cultural sequence was published in *NATURAL HISTORY* for March, 1943, (vol. LI) page 124.



A Lama of Mongolia

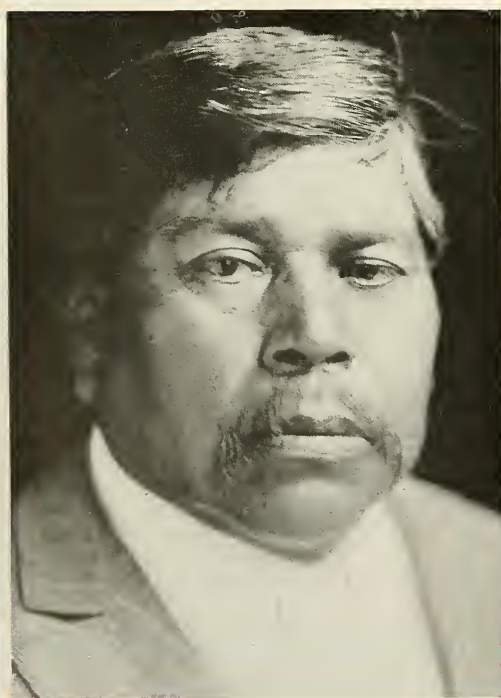


INDIAN TYPES: A Crow woman



Hopi man

NOTE the tendency of the inner corners of the Indian eye to point downward in contrast



Mission Indian



Cheyenne woman



Shasta woman



Arapaho man

to the horizontal alignment in the eyes of Europeans and their American descendants

A.M.N.H. photographs



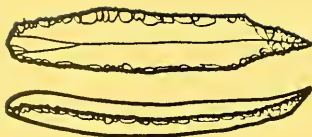
Iroquois man



Seneca woman



▲ **MOUSTERIAN MAN** had no chin; bulging eyebrows and a low forehead gave him a "gorilla-like" face



From *Prehistoric Man*, by Keith Henderson, E. P. Dutton & Co.

▲ **HE REVOLUTIONIZED** stone tools by using flakes. Above: two views of a long flake, chipped on its edges



▲ **LEAF-SHAPED FLAKE**, one side chipped. Earlier people worked only rough stones (cores), discarding the flakes

That he was a better man than his predecessors is clear. We are not sure whether he made the greatest of all human inventions, the campfire, or whether he borrowed the idea from some earlier species of man.² This is a subject of controversy, but he used fire regularly. However this may be, he revolutionized the art of making stone tools.

His predecessors seem to have been doomed to one idea in chipping out a stone tool. They selected a stone of suitable size and shape, then improved upon the shape Nature gave it by chipping one end to a point—making a "fist axe," as the archaeologist calls it. They were too stupid to realize that the chips they threw away could be shaped into finer tools for delicate work; such thinking seemed to be above their mental age. Mousterian Man did realize this and he may also have conceived of handles for the axe, because they appear with his successors. We cannot be sure of the credit for this, but about another idea of his there can be no doubt. He buried his dead and placed in the grave food, stone tools, and other objects used in life. Apparently he

conceived of the human spirit as immortal. So let us raise our hats to Mousterian Man, who blazed the trail for us in 20,000 years of groping and toil.

These are the men William James had in mind when he wrote the following impressive lines:

Bone of our bone, and flesh of our flesh, are these half-brutish prehistoric brothers. Girdled about with the immense darkness of this mysterious universe even as we are, they were born and died, suffered and struggled. Given over to fearful crime and passion, plunged in the blackest ignorance, preyed upon by hideous and grotesque delusions, yet steadfastly serving the profoundest ideals in their fixed faith that existence in any form is better than non-existence, they ever rescued triumphantly from the jaws of ever-imminent destruction the torch of life which, thanks to them, now lights the world for us. How small, indeed, seem individual distinctions when we look back on these overwhelming numbers of human beings panting and straining under the pressure of that vital want! And how inessential in the eyes of God must be the small surplus of the individual's merit, swamped as it is in the vast ocean of the common merit of mankind, dumbly and undauntedly doing the fundamental duty, and living the heroic life! We grow humble and reverent as we contemplate the prodigious spectacle.

Human Immortality.

Could our first Americans have been Mousterians? No. In two caves in southern Chile Junius Bird, of the American Museum of Natural History, found some skeletons of these New World pioneers. To him and Mrs. Bird belong the credit for a positive answer to the racial origin of these first Americans. With these skeletons were the bones of the extinct sloth and the wild horse, the latter the chief game animal of these early hunters. Yet the skulls of these human beings are not "gorilla faced," like the extinct Mousterians; they were men of modern build, or *Homo sapiens*. Further, they closely resemble American Indians, especially the long-headed type of Indians still prevailing in some parts of the Americas. They can qualify as ancestors of the Indians we know. Another important fact is that their campfires and kitchen refuse were upon the original floors of the caves they occupied, whereas above them rise the debris of four additional culture periods. Predecessors there were none.

Asia, the Cradleland of the American Indian

This clears the way to the next question, for since the skeletons of the first American settlers are Indian in type, we need but determine the ancestry of the Indians as a whole. Not so very long ago our school books told

² See *NATURAL HISTORY* for November, 1943, (vol. LII) page 180.

▼ **TEETH** help link Indian with Asiatic origin. "Shovel-shaped" upper incisors, almost universal among Indians and certain Mongoloids, are rare elsewhere

From *Essentials of Anthropometry*, by Louis R. Sullivan



us there were five races of living men; white, black, yellow, red, and Australian. In time it was realized that Australians were even blacker than Africans, so the tendency followed to name four races; white, black, yellow, and red. Finally, when many resemblances between Indians and Asiatic Mongolians came to notice we were told that there were but three primary divisions of mankind; white (Caucasoid), black (Negroid), and yellow-red (Mongoloid). For example, Indians and Mongolians have straight, coarse black hair, without exception. The hair of Negroid peoples is kinky, woolly, or frizzy. Caucasoid hair is finer, tending to be wavy and frequently curly, with color varying from blond to black. The upper incisor teeth of Indians are spoken of as "shovel-shaped" (*see illustration*). This characteristic is practically universal among Indians but almost never observed among Europeans; it is rare among Negroes, but very frequent among Chinese and Japanese.

We often hear the remark that an Indian can be recognized by "high cheek bones." This is a loose term of speech to designate the unusually wide face of Indians due chiefly to their prominent zygomatic arches. Sometimes the Indian face is said to appear disharmonic, because it is much wider across the arches than across the temples. This trait is common among Mongoloid peoples, also.

When we speak of the Mongoloid as "yellow" and the Indian as "red," we are using conventional terms. In actual skin color there is considerable variation, but the individual readings on a color scale for Japanese and Indians, for instance, are often identical. Further, some Asiatics speak of Caucasoid whites as "red" or "pink," which is nearer their actual skin color. On the whole there is little difference between the average pigmentation of the Chinese and the Indians. In passing, note may be taken of Mongolian spots, curious pigmented blotches on the skin of the back, frequent among children of Indians and Chinese. Such similarities as enumerated above point to remote ancestral affinity between Mongolians and Indians.

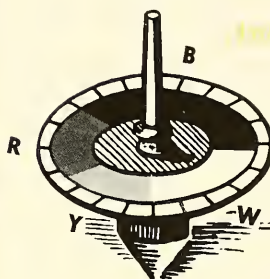
One peculiarity of Chinese and Japanese is the so-called "slanting eye," due to a fold in the upper eyelid. This is not characteristic of the Indian, though traces of it have been observed, especially among infants,

Skin Color

The spinning top is one of the anthropologist's most accurate methods of determining the color of an individual's skin in terms of an exact formula

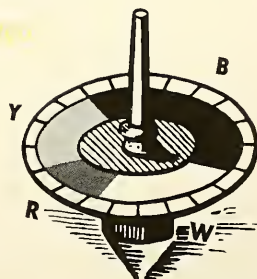
W=WHITE
R=RED

Y=YELLOW
B=BLACK

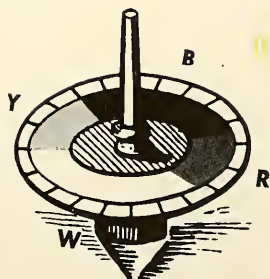


Though he is called the redskin, the Indian actually has only about 17% of red in his skin

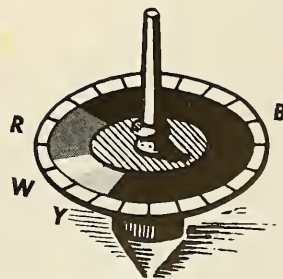
The Chinese, belonging to the so-called yellow race, has only 5% more yellow than the white race



There is only 6% more white than black in the disk which when spun duplicates the skin color of a white person



There is less than twice as much black in the color of the average Negro's skin as in that of a white person





From Essentials of Anthropometry

▲ PAIRS OF EYES cut from photographs to show the absence of the eye-fold and three degrees of such folding

which usually disappear as they become adults. Yet Indian eyelids are not straight like those of whites but tend to turn down at the inner corners as do the eyes of many marginal Mongoloids. Thus, though the In-

dians have not evolved an extreme eye fold like the Japanese, they have in their bodily inheritance a tendency which, if it had become genetically dominant, could have produced an exact parallel.

So we may sum up the evidence as showing positive parallels in face and body characteristics between Mongoloid Asiatics and Indians, not conspicuous among whites or Negroes, which speak for an ancestry common to Indians and Mongolian peoples.

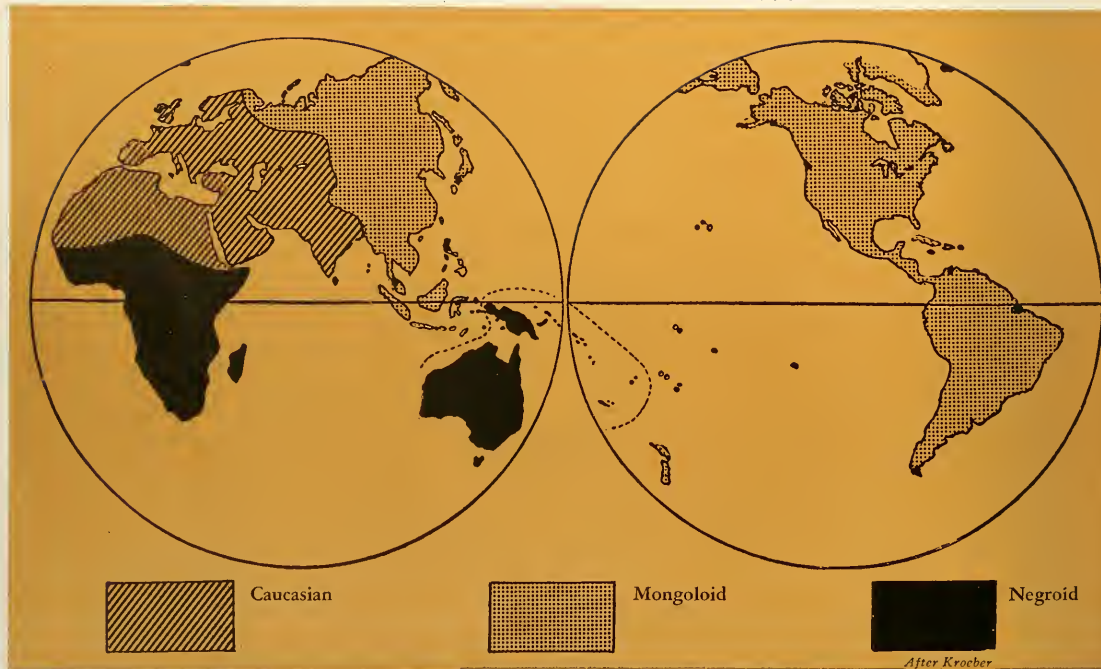
The Geography of the First Migration

It is often helpful to appeal to geography for aid in formulating answers to such questions as we have discussed. We may not know just how these three primary divisions of mankind were first distributed over the world, but even in the days of Columbus they occupied separate parts of the earth's surface (*see map*). Note that Mongoloids dominated a large part of eastern Asia and the whole of the New World. It is a reasonable conclusion that they were masters of eastern Asia before the first known

migration into the New World. Referring to the article on "Wheat and Civilization,"³ we can add that it was Caucasoid peoples who established these earliest civilizations. And all we know about the Old Stone Age is consistent with the conclusion that Caucasoid peoples swept over Europe after the extinction of the ancient Mousterians. If there were Negroid intruders, they were annihilated in short order. So that the accompanying map approximates the geographical distribution of the three grand divisions of mankind at the time the Caucasoids were enthusiastically exploiting cereals and domestic animals, thus laying the foundation for civilization.

The two more or less disconnected areas for the Negroids arouse our curiosity; the suggestion is that once they had a continuous distribution by land across southern Asia, to be split asunder by expanding Mongoloids and Caucasoids. However this may be, one thing is clear: the Mongoloids held the gateway to the New World. No other primitive people could have

³ *Ibid*, page 172.



Distribution of the primary races of man. Note that the white (Caucasian) occupies a central position flanked by the black (Negroid) and yellow (Mongoloid) respectively. There are a few small intrusive groups of each race scattered beyond the

main boundaries as drawn here, but this diagram conforms closely to the known distribution in 1492. Since 1492 there have been conspicuous migrations from each of these races into the New World, Australia, and Africa

penetrated this corridor. Eastern Siberia was probably heavily glaciated and uninhabited during the middle of the Pleistocene and possibly during part of the Late Pleistocene; but as the ice receded, the Mongoloids expanded into this marginal territory, and when eventually a way opened into Alaska they began a rapid push into the New World. So there is every reason to suppose that the first settlers in America were Mongoloids. The consistency between the geography of the case and the comparative data above adds additional certainty to our main conclusion.

Another aspect of these geographical relations may well give us pause if we turn our thoughts to the subject of race tolerance. How came this splitting up of the world among three varieties of modern men? Must one recognize an ancient deep-seated hostility to distinctions in appearance, skin-color, hair-form, etc.? And if there has been such a remote and long-continued reaction of this kind, is it reasonable to expect that the struggle for complete race toleration will be a mere "picnic excursion?" Can wishful thinking assure such an easy solution?

Yet we must not be led away from the problem in hand—the pre-white peopling of the New World and the dating of the first great Mongoloid migration from Asia. We have hinted that proof of the association of man with certain large extinct game animals was not available 20 years ago. It may, then, be excusable to review briefly the history of these new discoveries leading to this revolutionary advance in knowledge.

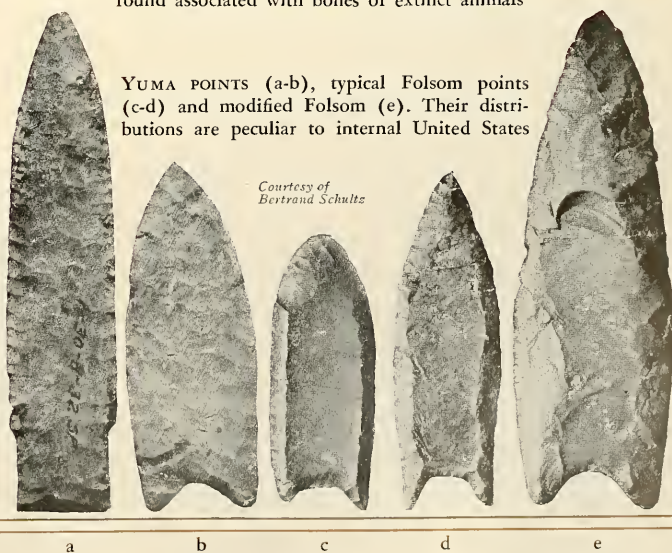
A Buried Bison Kill near Folsom, New Mexico

It is true that now and then before 1920 some amateur archaeologist claim to have found a single stone artifact near the bones of one of these now extinct animals, but the evidence was never such as to be convincing. Yet, as the country west of the Mississippi began to be occupied, more evidence came to light. In 1925, a colored cowboy in northeastern New Mexico, riding by a deep-cut ravine, saw a few bones sticking out of the bank. He pulled one of them out, knowing that the owner of the ranch was interested in such things. A local collector was sent to examine the spot. His report encouraged the excavation of the site by the American



LOCALITIES where stone implements have been found associated with bones of extinct animals

YUMA POINTS (a-b), typical Folsom points (c-d) and modified Folsom (e). Their distributions are peculiar to internal United States



Museum of Natural History and the Colorado Museum of Natural History.

As the work progressed, startling news was flashed over the wires—the complete skeletons of a small herd of bison were coming to light, accompanied by a number of flint dart points of a new type. The bison proved to be an extinct species—*Bison antiquus taylori*. Archaeologists, paleontologists, and geologists visiting the excavations were convinced. There was now no doubt that hunters had been present and that these bison were killed by them. Further, the tailbones of the skeletons were missing, suggesting that the bison had been skinned and their tails carried away with the skins. Visiting geologists, studying the deep earth cover above the skeletons, ventured to set the time for the event at 10,000 to 25,000 years ago.⁴

As the news of this find spread abroad, local amateur collectors in all parts of the West scanned their favorite collecting grounds for similar dart points. In 1931 reports of promising finds came from a site near Fort Collins, Colorado, the excavation of which was undertaken by Frank H. H. Roberts, of the Smithsonian Institution, Washington, D. C. This proved to have been a favorite camping place for these Folsom men, as they are called, yielding abundant materials associated with the extinct bison and mammoth. Near-by were camel bones. In addition to Folsom darts a few simple stone implements and fragments of what could have been bone tools were found, but no consequential traces of carving, no conspicuous ornaments, no polished stone, no pottery. We must, therefore, imagine people of a very crude hunting culture, living on bison flesh, far less advanced than the Magdalenian cave painters and sculptors of the Old Stone Age in Europe.

Again, to complicate the problem, some finely chipped stone points of a different type were found near Yuma, Colorado. These Yuma points are now considered as old as, if not older, than the Folsom points. Both are rarely found together.

To date, something more than a dozen sites have been reported at which dart points of extraordinarily skillful chipping similar to Folsom and Yuma types were clearly associated with bones of mammoth and

extinct bison, and probably with camel, sloth, and horse remains. So we repeat that no one has valid reasons to question the presence of men in the New World before all the animals peculiar to Pleistocene Time became extinct.

In none of these accepted sites in western United States has anything been found that warrants the conclusion that the first Americans were anything more than itinerant hunters. Among the Old World Stone Age hunters of the Magdalenian period pictorial art flourished to such a degree that rock pictures and carvings on stone and bone give us unmistakable pictures of many extinct animals, but nothing of this kind has been found in the camp debris of these New World hunters. If it is imagined that they may have made drawings on skins, there is no real evidence to support such a guess, since no carvings on stone or bone have come to light. It would seem strange that if drawing was highly developed, some one here and there should not have tried his hand on bone or stone. If he made baskets, it is queer that some charred fragments of them should not have been found, for charcoal is not easily destroyed. In the oldest sites in Oregon, "throwing sticks," or atlatls, were preserved—implements used to give greater force to the arm in hurling a spear. But when the bow and baskets appear there are no more bones of these extinct animals, though the use of atlatls did survive for a long time after the bow was known. Pottery has been reported with mammoth remains from one site in South America, but the skeptically minded wait for additional discoveries. Folsom and Yuma men showed great skill in chipping stone, but in many other ancient sites the working of stone was much more crude.

When an estimate of the age of any one of these sites is called for, geologists and paleontologists are consulted. Yet they are far from certain as to how to date them. Paleontologists tell us that there is no good reason for assuming that all the animals became extinct simultaneously; that some of them may have survived here and there for a longer time than others. The geologists suspect fluctuating climates and so look for signs of change in climate, but each locality must be carefully examined for these. Chief attention has been given to the best excavated sites for Folsom man

in Colorado and New Mexico. Professor Kirk Bryan has participated in the most searching of these studies, proposing an age of 25,000 years with a probable error of 10,000 in each direction. As a consequence, archaeologists usually take 10 to 15 thousand years to be the least possible lower limit. But you should be reminded that some instances of stratification have been reported which show that Folsom points are later than some other types of points. The logic of the case would thus require something to be added to the time interval taken for Folsom man to get at the time for man's first appearance in western United States.

Here we must rest the case until more evidence comes to hand. Whenever seriously studied geologically, marked changes in climate are declared certain. This calls for a reasonable antiquity, because large scale weather changes are gradual instead of sudden.

The human skeletal material we have from the Straits of Magellan, as we have stated, indicate a man not radically different anatomically from the Indian of historic times. Thus, the suggestion is that from the first, Mongoloid peoples held the gateway to the New World, so all early migrations from Asia have been Mongoloid. Such an assumption would agree with the observed basic uniformity in the anatomy of all Indian tribes, including the Eskimo. There is some ground for the belief that the latter are the most recent immigrants.

To one question there is still not even the beginning of an answer: "What caused these animals to become extinct?" The horse, the camel, and the elephant survived in the Old World; why not here? What carried away *Bison antiquus taylori*, and later caused a new species of modern bison to overrun the Great West? And what about those old Folsom plains Indians, who depended upon *Bison antiquus taylori* to the same degree as the plains Indians seen by Coronado in 1540 depended upon the modern species of bison? Did the hunters starve out and become extinct like the animals they hunted, leaving America a lonely virgin country for a new migration of Mongoloids with bows and arrows and dogs? No doubt the advance in knowledge and research skill of future generations will give the final answer to these questions.

⁴ For further information see "The Antiquity of Man in America," by J. D. Figgins, *NATURAL HISTORY* for May-June, 1927, (vol. XXVII), page 229.

AMERICAN PRONGHORN



A speed of 45 miles an hour, a distinctive pair of horns, and a patch of hair that flashes in the sun almost like a polished tin pan, distinguish an animal that ranged the West 100,000,000 strong less than two centuries ago

By WILLIAM M. RUSH

In the Sullivan antelope refuge in Montana where chalk cliffs bordering Big Coulee break off into grama grass and sagebrush prairie we watched a mother pronghorn go into action against one of her traditional enemies.

She jumped ahead and up as if powered by steel springs, came down with all four feet bunched closely together, and we saw a bit of turf fly. Again she jumped, and again, until she had alighted on the same spot a half dozen times. When she had gone away to graze, we went down to see what had happened. A sizeable rattlesnake lay cut to pieces in the trampled sod.

We searched the surrounding terrain for pronghorn kids. Mother antelope went to a lot of trouble to draw attention to herself and away from her young ones. She trotted with head high, like a thoroughbred, directly away from us for 200 yards, then stopped to browse the tender tips of sagebrush. Now and then she looked up to survey the countryside but never straight at us, although I imagine she did not miss a single move we made. Several times she walked close to us, snorted, and trotted off again. After a good half hour we found the two kids curled up under sagebrush. They struggled erect on pipe-stem legs and streaked for new hiding places a hundred yards away. Mother browsed her sagebrush as if she were quite unaware of what was taking place. She seemed to know that there was no harm in the two-legged beasts; or if there were, she dared not do anything about it.

It was a different story one cold May morning in Yellowstone when a coyote threatened a pronghorn's kids. She ran furiously at the wild dog with front feet slashing at its back. When the coyote dodged at right angles, she rammed at it with her pointed horns. For a moment it

seemed that the coyote would be cut to pieces like the rattlesnake had been, but the wild dog was too clever. It darted crookedly into the sagebrush and escaped. Had the mother been less alert or less aggressive she would have lost one or both of her young ones.

The American pronghorn, or antelope as it is often called, is a strictly American animal, with no close relatives anywhere in the world. It is the sole member of the zoological division of *Antilocapridae*. This scientific name translates into English as "antelope-goat-family," and the pronghorn has some characteristics of both families.

In size the pronghorn approximates a small deer. One hundred and twenty to 140 pounds is good weight for a buck. The does weigh slightly less. Both sexes have horns, hollow over a bony core, like those of the cattle family, but shed them every year in the fall or early winter. The bucks' horns show through the skin at the age of four months. When fall comes these tiny horns are shed and new ones grow. A prong develops directly over the eye as the animal reaches maturity. The females have shorter, more slender horns which do not possess a prong. In both sexes the points of the horns are very sharp.

Our pronghorn is beautifully colored. Its upper parts are reddish brown to light tan, depending upon the season, being lightest in winter and early spring and darkest in August and September. The muzzle, mane, horns, spots on the neck, and a splash below the ear are black. The belly and under parts of the neck are gray, with a strong tendency to whiteness in the winter. The buttocks are whitish when the hairs lie relaxed and blend well with the general color pattern and the animal's surroundings.

When excited or otherwise aroused the hairs on the buttocks stand straight up and have the property of

reflecting light almost as well as a polished tin pan. As the animal gallops over the ground with head held low like a scared sheep, or bounds with head high like a mule deer in brush and rocks, the rump patch flashes a warning signal to other pronghorns for miles around. There may be a regular heliograph code; but if so, it has not been deciphered by humans.

Curiosity is an outstanding trait in the pronghorn family. I once tested out the old story of how pronghorns could be attracted by a flag. There were dozens of the graceful animals in plain sight when I cut a willow switch about six feet long, tied a white handkerchief to it, and propped it in a sagebrush. As I took up a station 50 yards distant and sat down to wait, every antelope in sight promptly disappeared; even a scattered band of 26 that had been grazing on a knoll five miles away. The whole country around was barren of pronghorns as far as the observer was concerned. Instead of attracting them I had scared them away.

I waited half an hour, an hour. They began to show up from far and near to stare at the white flag. Gradually they edged closer. The coulees and depressions gave up more of them. There were a hundred pairs of eyes looking, a hundred nostrils snorting and blowing. A few of the animals drifted up to within 200 yards.

A loud snort came from close behind my hide-out. A magnificent buck with horns more than a foot long stood with head high. He stomped the ground with his forefeet, snorted again, and advanced a few steps. He was not more than 75 yards from me.

How close to the white flag would curiosity drive the big buck?

Fifty yards—half a city block—almost close enough to kill with a .22 rifle. Then he caught the man scent and retreated wildly, his rump patch heliography flashing a warning message to the others.

The pronghorn has sportive moods. He loves to run. If no other contestant is available he will race some of his own fellows. A man on horseback is promptly challenged if he rides in the open and has no gun. Unless the horse is extra fast the wild creatures will literally run rings around it.

Pronghorns will race even an automobile. At 25 miles per hour, if the terrain is fairly smooth, the pronghorn will run parallel for a few hundred yards to test out the speed of his opponent. Then with a fine show of speed he will forge ahead angling in and across the road ahead of the car.

In a straightaway chase across a perfectly level and smooth alkali dust bed the buck will make 45 miles an hour for one or two hundred yards before whirling sharply aside, sides heaving, mouth wide open, tongue hanging out, to let the monster go by.

For a full mile it is doubtful if a pronghorn can equal the speed of a race horse. That would be about 30 miles an hour. Compared to some of our birds in flight they may seem rather slow, but they are much faster than any other wild quadruped in America.

At the beginning of the nineteenth century there were probably 100,000,000 pronghorns on the prairies of what are now the seventeen western states. In 1924 the United States Biological Survey made an estimate and arrived at a total of 26,600 for these same states. Total extinction within a few years was predicted. The principal reasons given for the spectacular decline are usually three: fencing of range, killing by coyotes, and killing by hunters.

Yet in spite of the fact that as much or more land was under fence in 1939 than in 1924 and that coyotes are more numerous than ever, the governmental bureau that has taken the place of the old Biological Survey estimated an antelope population of 165,000 in 1939.

What could be the reasons for the phenomenal increase of over 600% in fifteen years?

Part of it may be optimistic reporting—the tendency of the times to big figures—, but all authorities are agreed that there has been a marked increase in pronghorn ranks.

Doubtless some of it can be ascribed to protection from hunting, but not



all. It might be to some extent a natural cycle of increase, although such a cycle had not manifested itself in previous years.

More than likely it was a combination of favorable circumstances wholly unforeseen by conservationists. Cer-

tainly but little was done in a physical way, such as providing more forage for them during their period of increase.

Pronghorn kids readily become tame and are interesting pets. A kid raised on the bottle at the Silver Tip

BOTH SEXES of pronghorns possess horns, but only the male has the prong. The white rump-patch flashes under emotional excitement



A.M.N.H. photo

Ranch in Montana played like a goat. It delighted in pushing against a person's leg with all the abandon of a young billy. It ate like a goat, too. Bits of cloth, a leather glove, paper, or a pile of potato peelings were regular articles of diet. It was par-

ticularly fond of cigarette butts and any wrappers, such as tinfoil, that smelled of tobacco. Candy and other sweets were relished as well as bread scraps, breakfast food, bacon and eggs. In fact, this kid ate and thrived on almost all kinds of food that a goat might eat.

When fall came the kid deserted the ranch and was never seen again. It may have gone back to the herd which ranged 20 miles away. It was rutting season. The bucks were fighting one another for the choicest does. High excitement prevailed. Nights were cold, winter was coming on. Kids were being weaned from their mothers. The pronghorns raced at breathless speed across the prairies and over the foothills. No doubt the pet kid felt some of this tension and deserted his human friends for wild ones. He had demonstrated that his kind could and would live in close proximity to people, domestic stock, and even dogs.

Bucks fight one another viciously during breeding season. A prime buck may be able to hold as many as eight does in his harem. Young bucks will not fight an old one, but sometimes two of them work a neat seesaw game and start modest harems of their own. The two young ones approach an old buck's harem from opposite directions. The old fellow immediately races around his does and drives them into a compact bunch. Often the does are not very tractable and he is compelled to chase one or two of them a half mile to get them back into the fold. Meanwhile the young bucks sneak closer. When the old buck thinks they are too close, he takes out after one of them and puts it to

flight. The second young buck gets in some courting before he in turn is chased. Number one comes back swiftly and makes good the time while the old buck is away. Presently the master tires, a doe or two breaks from his fold and goes with the young bucks.

The period before birth in pronghorns is eight months, a full month longer than deer and three months longer than sheep and goats. Most of the hollow-horned grass-eating mammals, however, have a gestation period of nine months.

A curious anatomical feature of pronghorns is the absence of dew claws, the small hoofs which supplement the regular hoofs of nearly all cloven hoofed mammals. In a moose or caribou for instance, dew claws are a valuable aid in swampy soil or snow as the four toes of each foot spread out on top of the ground. In a deer, which travels mostly on firm ground, the dew claws are less of an asset. The antelope does not need them at all on hard prairie soil.

The power of adaptation to changing conditions is doubtless one of the big reasons why the antelope population of this country took such a big upward swing since the beginning of the twentieth century. It has been demonstrated in many ways. Forced by settlements into the mountains where snow becomes deep and covers the forage on the ground, antelope have learned to paw away the snow with their forefeet in order to get food. They have learned to eat mountain grasses, herbs, and browse plants instead of grama grass and sagebrush. In some localities they have learned that alfalfa fields, wheat fields, and other cultivated areas furnish bountiful provender. They have learned to run under the lowest wire of a barbed wire fence like a dog instead of breaking their necks against the wires. They swim across wide rivers and climb mountains as readily as mule deer.

Pronghorns have learned to live with sheep, cattle, and people. In several states they have done so well that hunting is again permitted. Long range rifles are teaching them new lessons, one of the most important of which is to stay a long way from two-legged beasts, for while the mother pronghorn can protect her youngsters from rattlesnakes and coyotes she has no defense against bullets except distance.

HUMBLE PLANTS

THE TENTH IN A
SERIES OF ARTICLES
ON STRATEGIC PLANTS

in the War Effort

From the dish cloth gourd to the vegetable ivory tree, a host of curious plants are playing unexpected parts in the struggle for a better world

By HAROLD N. MOLDENKE

A PLANT product concerning which not very much is seen in the newspapers, but which is of strategic importance nevertheless, is camphor. Many different substances derived from various plants are included under this term. True camphor is known also as *Japan camphor* or *laurel camphor*. It is a white, translucent, crystalline substance occurring in the wood and bark of the camphor laurel (*Cinnamomum camphora*), native to Japan, Formosa, and central China; and cultivated in many warm countries. Because of the present war, it is now practically impossible to secure supplies of laurel camphor.

The so-called "camphor gum" is obtained by distilling the leaves, bark, and chips of wood with steam and afterwards driving out the water and volatile oils from the distillate with a low degree of heat and then subliming the gum at 350° F. Purified camphor consists of a clinging mass of tough, colorless, hexagonal crystals which break apart easily but cannot be reduced to powder except by the addition of alcohol. Its chemical formula is $C_{10}H_{16}O$. Camphor possesses a characteristically strong and pleasant odor and a peculiar cooling aromatic taste.

Every householder of the older generation is familiar with camphor because of its former use in protecting furs and woolsens from the depredations of moths and other insects. Now it is largely replaced by naphthalene, a coal-tar derivative. This, however, was only one of camphor's many uses. It has long been an ingredient in many medical preparations, and it is used in the manufacture of celluloid, smokeless powder, and various other explosives.

Camphor, like most of our important economic plants, has had an interesting history. The aboriginal inhabitants of Formosa distilled camphor in a primitive fashion. In 1421 a band of Chinese freebooters attacked and captured Formosa and made camphor cakes an item of world commerce for five centuries. In 1895 Japan acquired the island as a prize in the Sino-Japanese War and modernized the industry. In 1904 camphor became an official legal monopoly of Japan, and Japan is still in control of its commercial production, except for the substitutes and synthetics. The

price was gradually worked up to \$2.35 a pound in World War I.

The British blockade of Germany during World War I forced German scientists to attempt the production of synthetic camphor. In this they were successful, bringing the price down to 50 cents a pound. A few financially unsuccessful attempts at producing synthetic camphor were also made in the United States, until, in 1931, DuPont bought up the struggling camphor industries and vastly improved the processing. The Tariff Commission awarded DuPont a 5-cents-per-pound tariff on Japanese imports in return for a promise to make the United States independent in camphor.

Synthetic camphor, however, is also a plant product, since it is prepared from turpentine oil. It is almost identical



Photos by Bureau of Plant Industry, U.S.D.A.

▲ A CAMPHOR TREE IN FLORIDA: the source of a product that became practically a Japanese monopoly when Formosa was acquired by Japan in 1895. The translucent crystalline substance occurs in the wood and bark of this tree, the camphor laurel, but other plants yield substitutes, and turpentine oil provides almost identical synthetic camphor

tical with natural camphor. The process by which it is made consists of first converting the turpentine into pinene hydrochloride (known commercially as artificial camphor) and then changing this into camphene by the elimination of the hydrogen chloride. Synthetic camphor is then produced by oxidation of the camphene. Four and a half million pounds were produced in the United States in 1941.

The term "camphor" is applied loosely also to various similar substances of widely different derivation. For instance, peppermint camphor or menthol is derived from the peppermint plant; cedar camphor comes from the oil of juniper; cubeb camphor from the oil of cubeb, thyme camphor or thymol from the oil of thyme, and matricaria camphor from the oil of *Matricaria parthenium*.

True camphor can be obtained from a wild western species of sage and a species of basil. Both sources have been investigated.

Perhaps most important of the camphor substitutes, however, is borneol or Borneo camphor. This is a crystalline organic compound obtained from *Dryobalanops aromatica*, native to Borneo, Sumatra, and Labuan, and

now, of course, also unavailable to the United Nations. The substance is deposited in the form of crystals in longitudinal cracks in the wood. To obtain it the trees are cut down, the wood fissures are opened, and the camphor removed. A large tree will often yield from 3 to 11 pounds of the valuable substance, but owing to the reckless manner in which the trees have been felled in the past without the planting of new ones, the forests of the Netherlands East Indies now contain comparatively few trees that are worth harvesting. The formula of borneol is very similar to that of common camphor, being $C_{10}H_{17}OH$. It is harder than common camphor and not so volatile. Pure borneol will sink in water, while common camphor will float. A similar substance, known as L-borneol, is derived from *Blumea balsamifera*.

Camphor comprises 20 per cent by weight of celluloid, which is a pyroxylin plastic. The camphor plasticizes the pyroxylin and robs it of its explosive property. Camphor for use in motion picture films has to be specially purified. Other substitutes for camphor have been successfully employed as plasticizers of pyroxylin—for instance, liquid tricresyl phosphate

and solid triphenyl phosphate (which is more expensive). Synthetic camphor is also used in synthetic fabrics, such as rayon, which replaces much of the silk on the market.

Safrol, formerly obtained from oil of sassafras, is the chief constituent of camphor oil, which is obtained with the camphor by distillation. It is used to mask the odors in laundry soaps, glues, pastes, shoe polish, inks, and other odoriferous household commodities, in addition to being employed as a flavoring agent, and in aromatic bitters and perfumery.

Photo by Bureau of Plant Industry, U.S.D.A.



THE IVORY NUT PALM: source of "vegetable ivory" or tagua nuts, is found chiefly in Ecuador. The United States Army has recently procured over two and one-half million buttons made from these nuts



Photo by Charles Perry Weimer, Three Lions

THE CARNAUBA or Brazilian wax-palm is the source of a strategically important wax, many of whose war uses cannot be listed for security and other reasons. Once used in the manufacture of phonograph records and furniture polish, carnauba wax now serves in the production of waterproofing, varnishes, and electrical equipment. It is abundant in the semi-arid regions of northeastern Brazil

A CARNAUBA WAX-PALM PLANTATION at Fortaleza, Brazil. On the leaves, the wax serves to protect the tree against the dry climate; and in wet seasons the tree yields less. The natives sometimes derive food, shelter, and clothing from the wax-palm



Photos by Severin from Three Lions

▲ MOST FAMILIAR as the source of chewing gum, the sapodilla tree contributes also to the war effort in the manufacture of dental supplies and in other ways. This worker in Guatemala is cutting the trunk of a tree crosswise to permit the chicle sap to flow down

➤ THE BOILED CHICLE is poured into a mold

Carnauba

Wax from the *carnauba palm* (pronounced kar-now-ba) or Brazilian wax-palm (*Copernicia cerifera*) is now helping the armies of the United Nations. Before we turned to the production of armaments on a gigantic scale, Brazil sent large quantities of carnauba wax to the United States for entirely pacific purposes. It helped to make sweet music in phonograph records and imparted a bright polish to the furniture and floors of innumerable homes. More and more uses were being found for it in industry, and it entered into the manufacturing processes of products ranging from lubricating oils to soap and sound films. It was even used for hardening milady's lipstick. Now the protective coating which Nature provides for the leaves of the carnauba palm has an equally versatile role in

war industry. Many of its specific war uses cannot be catalogued for security and other reasons, but the importance of the wax to the war effort is indicated by the close control over supplies exercised by the War Productions Board, to make sure that the imports from Brazil are channeled into the most essential of the war-expanded uses.

The heavy wax makes excellent waterproofing and coating material. This quality alone opens up a wide range of wartime uses in the preservation of military equipment and munitions, in the treatment of airplane parts, and in the covering of cables. It is widely employed in the manufacture of electrical equipment and varnishes. It waxes skis for Arctic fighters, and carbon paper and type-writer ribbons for Army, Navy, and war industry offices. Thus, in war or peace, the expanding variety of uses



for carnauba wax makes it one of the most consistent items of import from the great Brazilian arsenal of raw materials. Imports have increased substantially in recent years.

The carnauba is one of numerous palms growing by countless millions in the semiarid reaches of northeastern Brazil. It grows over large areas extending from the Amazon River to the state of Bahia, frequently in groves close to river valleys. It is graceful, with a straight trunk, and grows slowly to an average height of 25 to 35 feet. The bark is rough and scaly. Fan-shaped leaves spread out to give the crown a pinwheel-like appearance. It is equipped by Nature to withstand the hot, dry season of northern Brazil, and the wax which forms a protective coating over the leaves is part of this equipment. Less wax is produced in wet years. Manpower and wartime transportation



Photos by Severin from Three Lions

SOLID BLOCKS of chicle being carried in a native canoe to Flores, center of the chicle trade in Guatemala



➤ **A FRUITING BRANCH** of the chewing gum tree (*Sapota acbras*), a well-known and widely-used fruit in south Florida

Photo by Bureau of Plant Industry, U.S.D.A.

difficulties also limit the supplies. For inhabitants of the carnauba palm country, parts of the tree also at times provide shelter, food, and clothing.

Beeswax and substitutes

Honey, produced by bees from wild and cultivated flowers, is being imported from Guatemala, Costa Rica, and El Salvador, and these countries now appear as prospective sources of beeswax, which is not produced in sufficient quantities in the United States.

The jojoba bush (*Simmondsia californica*) has been found to produce an excellent liquid wax, used as a substitute for beeswax in making varnishes, phonograph records, and electrical insulation. The nuts which yield the wax command as much as \$200 a ton for export to the United States. The plant is well adapted to growth in Arizona and New Mexico, as well as south of the Rio Grande, and experimentation in its cultivation under irrigation has been started in Arizona. It may therefore provide a new source of wealth for the semiarid regions of Mexico and Central America, and serve as a substitute for the precious *candelilla wax* derived from the tropical spurge, *Pedilanthus pavonis* and *Euphorbia antisiphilitica*.

Glycerin

Wartime restrictions are banning the use of glycerin in foods, tobacco, cosmetics, and toilet preparations, and its use is being reduced in many medicines. The reason for this is the tremendous importance of glycerin in the making of explosives. Apple juice is being used as a substitute for it in tobacco, where its function is to keep the tobacco moist.

Vegetable Ivory

The United States Army has recently purchased over 2½ million buttons made from "vegetable-ivory" or tagua nuts, the nutlike seed of a South American palm (*Phytelphas macrocarpa*). The nuts are turned and carved and are imported mostly

from Ecuador. Buttons made from these nuts are valued highly for military purposes because they withstand cracking under pressure and intense heat and remain colorfast through numerous washings.

Chicle

The usual source of chicle is the latex of sapodilla (*Sapota achras*), native to the wilds of northern Guatemala, British Honduras, and Mexico. It is very valuable in the manufacture of dental supplies and in other ways, although by far its most important peacetime commercial use is in chewing gum. In the years 1937 to 1939 the United States imported over three million dollars worth of chicle annually. Recently it has been discovered that *Couma macrocarpa* and members of the plant family *Caryocaraceae* also produce chicle.

Sponge Plants

Another surprising wartime necessity is the dishcloth gourd (*Luffa cylindrica*). Luffa gourds are big, awkward vegetables resembling cucumbers, used as oil filters in naval vessels. Also known as "sponge plants," these gourds have a fiber structure almost like woven fabric, and when processed they serve better than any other material for cleansing the oil and dirt from the water passing through the boilers of ships. Before the war these gourds were largely imported from Japan. Since then the Navy and the Department of Agriculture have been encouraging their growth in this hemisphere. Yale University and Department of Agriculture plantmen have shown that the growing season in the northern states is not long enough, but by starting plants indoors and later transplanting

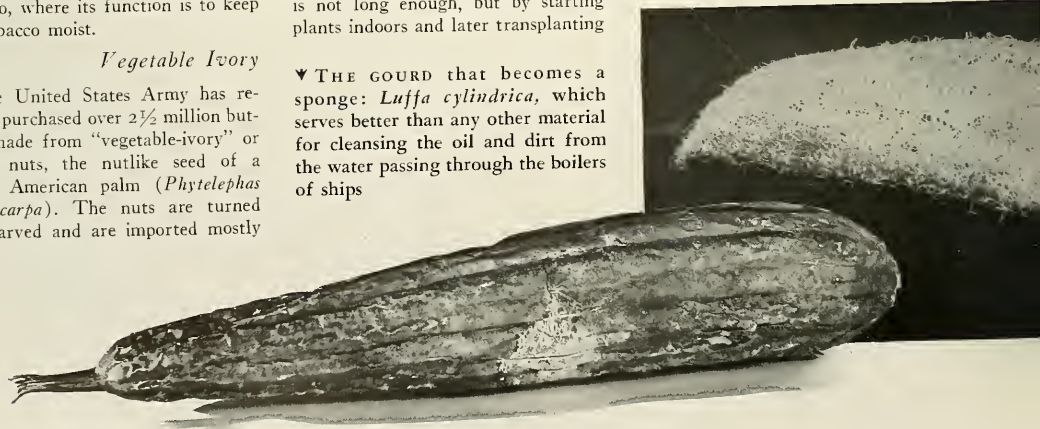
them outside a few mature fruits can be produced for further breeding investigations.

A cultivation program for luffa gourds has been started in several Latin American countries. The vines may be trained to climb up trees and over fences. About 140 gourds can be expected there from a 40-foot row of vines, and the individual gourds may attain a length of 26 inches. The fiber of these gourds is successfully used for washing and bath sponges, table mats, packing material, pillow and mattress stuffing, and insulation. In Japan the fiber is used for matting and in the making of baskets, sandals, and toys. It can also be used as an inner sole in shoes, where it is comfortable and can be scrubbed with soap and water. One variety in the very immature state is used and sold in Chinatown as a table vegetable like summer squash.

Cottonseed Oil

Cotton (derived from various species of *Gossypium*) is America's largest source of vegetable oil. Virtually all of the 1½ billion pounds of cottonseed oil produced annually is consumed in the form of basic food products. Representing 48 percent of the nation's total production of edible vegetable oils in 1942, it provided in that year enough oil to furnish every man, woman, and child in the nation with 10 pounds of food fat. This is equivalent to filling the total fat re-

▼ A FIBROUS MASS almost like woven fabric remains after the "dishcloth gourd" has been processed. Many are familiar with this peculiar plant in the form of a bath sponge. Its other uses are varied



▼ THE GOURD that becomes a sponge: *Luffa cylindrica*, which serves better than any other material for cleansing the oil and dirt from the water passing through the boilers of ships

quirements of the Army, Navy, and 18 million civilians.

Cotton's tremendous strategic importance as a feed crop is indicated by the fact that in 1942 about one-third of the nation's total production of feed-meal came from cottonseed. The significance of this phase of cotton's contribution to the war effort is underlined by the fact that farmers were asked to produce 57 billion quarts of milk and 11 billion pounds of beef last year—an impossible task without adequate protein feeds. The 1942 cotton crop yielded enough essential proteins to feed dairy cows producing one-fourth of the above mentioned quota of milk. It was a quantity sufficient to produce almost one-fifth of the total beef supply set for the year. As protein the 1942 cotton crop was equivalent to more than 200 million bushels of corn and other grains. As roughage for fattening beef cattle it was the equivalent of 2 million tons of corn silage and 2½ million tons of sorghum silage.

Soybean

Only a few years ago soybeans

(*Soja max*) were virtually unknown in America. In 1943 the soybean crop of the United States was about 200 million bushels. Because of their extremely high nutrient value most of these soybeans go into human food and livestock feed. Oil crushed from the beans goes into salad oils, oleomargarine, cooking fats, and other foods rich in energy and fat. From the meal left after oil is removed are made flour, breakfast foods, macaroni, infant foods, crackers and a whole new line of foods rich in proteins, vitamins, and minerals. Even the whole bean is used widely in an increasing variety of dishes. More and more of these foods are needed, not only now in wartime with workers laboring longer and harder hours, but after the war when the task of feeding a large percentage of the war-torn and starving world will be ours.

Fertilizer

The war calls for the use of chemical nitrogen for military purposes. Because of this need, the use of nitrogen

in the manufacture of complete chemical fertilizers has been restricted. Cottonseed meal and soybean meal are among the several vegetable products that are serving the gardener as substitutes, in addition to the animal sources such as manure, blood, tankage, and bonemeal.

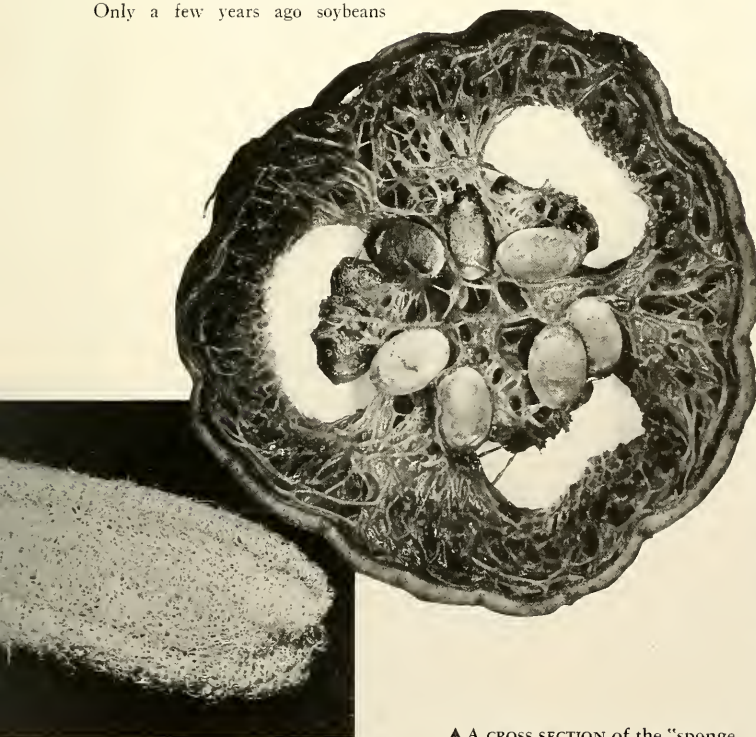
Peanuts

It may come as a surprise to many readers to know of the great value of the lowly peanut (*Arachis hypogaea*) in the war effort. The peanut is a native of South America. From there it was carried to Africa, where the Bantu natives called it "nguba." From this native name comes the American term "goober nut." Slave traders used peanuts to feed the Negroes whom they were taking to the Jamestown colony, and it was only incidentally that the planters discovered that the Virginia soil and climate were ideal for the peanut crop.

Peanut oil is now used for a multiplicity of purposes. It is made fine enough to lubricate the most expensive watches and thick enough for a tractor motor. Because it will not smoke unless heated to over 450° F., peanut oil is carried by submarines for underwater cooking. It has been found ideal for massaging because of its penetration, viscosity, and oiliness. It is used for shaving creams, cosmetics, shortening, oleomargarine, and soaps, and it provides glycerin for explosives. Peanuts yield proteins that can be used for the manufacture of synthetic wool fibers as strong as ordinary wool. Plastics for commodities ranging from ash-trays to automobile bodies have been made from the lowly goober. Fibers from the hulls are used for making wallboard insulation blocks, linoleum, livestock-bedding, floor-sweeping compounds, and dynamite. Experiments indicate that they may also be a source of synthetic cork. Every English lifeboat contains 14 pounds of peanuts in its emergency rations. Each pound contains a man's daily requirements of 2700 calories, about 118 grams of protein (about 1½ times an adult's normal needs), and abundant amounts of phosphorus, calcium, iron, and vitamin B₁.

Papaya

The papaya (*Carica papaya*) is one of the long list of indigenous New World plants, like quinine and rubber, which have been successfully exploited in the Far East, whence we imported our supplies before the war.



Photos by N. Y. Botanical Gardens

▲ A CROSS SECTION of the "sponge plant" shows the network of fibers that makes it useful for mattress stuffing, insulation, matting, and packing material



U.S.D.A. Photos by Knell

◀ **SOYBEAN HARVEST.** Scarcely known in America a few years ago, the soybean has gained rapid prominence because of its high nutrient value. Salad oils, oleomargarine, breakfast foods, macaroni, and infant foods are made from it. The machine moves through the field, cutting the ripe plants and threshing out the beans. A scene in Illinois

▼ **THE OIL** is pressed out of the soybean and poured into tanks for subsequent filtering



Cuba, Haiti, Puerto Rico, Jamaica, Trinidad, and other Caribbean countries are now making valiant efforts to bring back the cultivation of the papaya to this hemisphere. The papaya is a greenish-yellow or orange melon-like fruit, sometimes as much as 20 inches long. It is relished in Florida and elsewhere as a breakfast fruit and as a salad, usually with a few drops of lime juice added. Recently papaya juice has become popular as a soft drink. The plant's chief value, however, lies in its digestive enzyme, called papain, found in the dried latex of the plant. This enzyme resembles pepsin, which is obtained from animal sources. Papain has many commercial uses and, in addition to other qualities, it has the ability of making tough meat tender. In 1941 the United States imported over 300,000 pounds of papain, valued at \$453,000. The bulk of it came from Ceylon. Cuba hopes soon to be in a position to supply the entire United States demand. Papain is obtained by making cuts in the skin of the green fruit. The latex then drips out and is caught up in a cup and thus marketed. This latex extraction does not prevent the fruit from ripening.

Coconut

Among the many uses of the coconut (*Cocos nucifera*), one has assumed special importance since the war. This is the use of the husks to produce char for the manufacture of

gas masks. Coconut char is on the Government's list of strategic materials. The husks are also used as a fertilizer to supply the all-important plant-food, potash. The shells of the pecan (*Carya pecan*) are also being used to make activated charcoal for gas masks.

Coconuts are a leading source of vegetable fats and for years have been imported from the Far East in great quantities. Now we are obtaining them from Honduras, Nicaragua, and Panama. *Cohune* nuts are the product of another tropical American palm (*Attalea cohune*), the wood of which is used for construction and the nuts for oil. It is an extremely plentiful palm all through Central America and yields a kernel oil much like that of the coconut and similarly used for making fine soaps, butter substitutes, and pharmaceuticals.

Vitamins

Everyone today appreciates the tremendous value of vitamins. In wartime these substances are more essential than ever, and even strategic in importance. The search for vitamin-bearing plants has given botanists a great amount of new wartime work, especially in Russia, Greece, India, China, and other wartorn countries, where starvation is a real or threatened menace. One of the most important of the vitamins is vitamin C. It is in practically all fruits and vegetables, but where these are unavail-

able in the diet, the need of vitamin C becomes paramount and all possible sources become important. Now we know that the fruits or "hips" of wild roses (*Rosa*) are a good source of this substance, and much work is being done in Russia to discover and develop high-yielding strains. In that country it has also been ascertained that unripe Persian walnuts (*Juglans regia*) contain Vitamin C, and so the collection of these nuts and the preparation of vitamin-bearing extracts from them have been organized as a wartime necessity.

Pine needles also contain it. The Russians' search for vitamin C in conifers is an interesting example of the rediscovery by modern scientists of a fact known to at least one primitive civilization. When scurvy broke

out among Cartier's men in the winter of 1535-1536 on the St. Charles River where Quebec is now located and 25 of the party died and only three or four were left able to move about, an Indian brought boughs of a native conifer, made a decoction therefrom, and eventually brought the remaining men back to health. Although vitamin C is present in pine needles in small quantities, the abundance of pines in all northern countries makes this an especially important source. During the long siege of Leningrad the lack of vitamin C was a problem. Decoctions made from pine needles are reported to have played an important role in the prevention of scurvy.

Since the beginning of the war a number of grasses have been found to contain this vitamin. A daily requirement of 50 milligrams is needed to protect a person against scurvy. Some species of roses yield 500 milligrams of vitamin C per 100 grams of fresh pulp, whereas oranges—the familiar source—only yield 54. For further comparison, Persian walnuts yield 1500 milligrams, black walnuts 750, shagbark hickory 500, pignut hickory almost 500, mockernut 70, lemons 56, grapefruit 39, cabbage 35, strawberries 34, tomatoes 22, lettuce 14, peaches 9, and apples 7. Powder obtained from the fruits of the guava (*Psidium guajava*) is now being used by British troops in a few areas as a rich source of vitamin C. Dried guava

is so rich in this substance that a little over 4 ounces would protect an Arctic soldier or explorer from scurvy for almost 3 months when taken at appropriate times.

Another waste product from which a good wartime use has been found is old lettuce leaves. The greener, wilted leaves that form the outside of the head are usually torn off before the white iceberg heads are sent to market. A process has been found for extracting carotene, or provitamin A, from these old leaves. It is useful in fortifying butter, margarine, and other food products. A \$30,000 extraction plant is now being constructed. Heretofore these outer

leaves were shredded and made into a livestock feed, 25 tons of lettuce making one ton of stock meal. Now, after shredding, the carotene will be extracted, and there will still be a ton of feed left.

In Russia, where the intense war effort is forcing all manner of food substitutions, a flour is now produced from dried rowan berries (*Sorbus aucuparia*). It is added to ordinary flour in proportions up to 25 per cent and is used for baking pastry, etc. The American species (*S. americana*) might serve as well here. In Russia, flour made from bird cherries (*Prunus avium*) is now also being used in making cakes.

{Next month: spices, foods, beverages}



U.S.D.A. Photo by Foreign Agricultural Relations



U.S.D.A. Photo by Dorsett and Morse

▲ AFTER THE OIL is extracted, the residue is pressed into cakes. This is a scene at Dairen, South Manchuria

◀ PAPAIA: the fruit that has the ability to make tough meat tender. The milky juice, valuable as a digestive enzyme, is seen dripping from cuts in the skin of the green fruit. The fruit itself is relished as a breakfast dish and salad. Though native to the New World, papaya cultivation was exploited in the Far East, where we procured most of our supplies before the war. Efforts are being made to bring papaya into its own in the Western Hemisphere

YOUR NEW BOOKS

ARCTIC MANUAL • AMERICAN INDIAN • ANGLING
JAPAN • OIL • NATURAL PRINCIPLES OF LAND USE

FIELD BOOK OF FRESH-WATER ANGLING

----- by John Alden Knight

G. P. Putnam's Sons, \$3.00
207 pages

MR. KNIGHT needs no introduction to anglers, and his word on the subject of fresh-water angling equipment and its use is authoritative.

The title of the book, as titles of angling books seem doomed to be, is rather misleading. The book is not about fishes but is entirely limited to a discussion of fresh-water angling equipment, and it is a compendium of information about the tools of that art. It is written in a simple but oddly fascinating style, and I have recently seen several people, whose catch for their combined lifetimes probably totaled one bluegill, completely absorbed in its perusal.

An immense amount of exact information is contained in some 200 pages, 32 of which are devoted to descriptions of popular fly patterns. The contents are best indicated by a list of the chapter headings: Rods, Reels, Lines, Leaders, Anglers' Knots, Hooks, Flies and Fly-Rod Lures, Bass Flies and Bass Bugs, Casting-Rod Lures, Anglers' Accessories.

This data is assembled in such form that the angler can readily find it. The diagrammatic drawings, by Schaldach, are clear and numerous, and there is an adequate index.

Hours of painstaking precision labor are necessary to turn out the piece of equipment about which the angler's kit is built—the rod. Mr. Knight describes the process in detail and also discusses the behavior of different types of rods in the angler's hands. The chapter on lines is also detailed, and the author's short section on Nylon line will interest salt-water anglers. The very clear and practical section on Anglers' Accessories is worth consideration by anyone who goes on or into water of any kind to catch fish by lines, harpoons, or seines.

The publishers are to be congratulated on the inclusion of this useful and interesting book in their Field Book series.

F. LAMONTE.

NATURAL PRINCIPLES OF LAND USE

----- by Edward H. Graham

Oxford University Press, \$3.50
274 pages, 32 plates, 8 figs.

TO those who have been interested in conservation in any of its many phases, the one central fact that is almost

always apparent is the controlling influence of the land. Although in many instances land deterioration is a rapid and a rapidly accelerating process, as in certain areas of the South, deterioration is more prevalent in far less dramatic fashion. In many instances, as on the watershed of the Rio Grande, the overt evidences of deterioration lie in the silt-filled reservoirs of the middle valley several hundred miles from the area. Moreover, much deterioration takes place over such a long period of time that successive phases, as the changes in the forest coverage of northern New England, are separated not by the days and years of man, but by his generations. It therefore comes about that man tends to view much of this deterioration with complacency as to its occurrence and with pessimism as to its control.

Dr. Edward H. Graham in his *Natural Principles of Land Use* is neither complacent nor pessimistic. He roots his discussion in the use of land for living things and defines his problem by reviewing and studying the forms of life dependent upon the land. From this and from equally lucid discussions of climate, soils, water resources, and the like he draws a compelling picture of the significance of land usage to man's welfare and the dangers in neglect.

One startling outcome of a reading of this book is the optimism it engenders as to the time and possibility for regeneration of wasted areas. By graphic description and by far more graphic photographs the meaning of which is inescapable, Doctor Graham shows what can happen for good if man purposes that good. This book should be read, at least, by all who are disturbed by present conditions throughout our country; it must be used by those who would do something constructive about them.

CHARLES RUSSELL.

JAPAN'S ISLANDS OF MYSTERY

----- by Willard Price

John Day Co., \$3.00

IN an earlier book, *Pacific Adventure*, Mr. Price gave us a glimpse into the Micronesian empire of the Japanese—an area of the Pacific from which little information had been published for over 20 years. In the present volume he has brought his knowledge into line with our present interests in those islands and thus performs a real service to those eager to acquire some conception of the conditions which face our forces there. The Bonin Islands, Saipan, Rota, Guam, Yap, Truk,

Ponape, Kusaie, Jaluit are the islands which Mr. Price describes for us at first hand. His experiences with official Japan, with the natives overwhelmed by the Nipponese steam roller, and his comments on the military significance of these once forgotten isles make absorbing reading. Although his life was attempted on several occasions by the Japanese who were reluctant to have an American see their fortress islands and live, he managed to complete his trip successfully and acquire invaluable information. With so few books on this part of the world available, almost any account would have had exceptional appeal. Fortunately Mr. Price's book rises superior to such fortuitous circumstances. It is good reading on its own account.

H. L. S.

ARCTIC MANUAL

----- by Vilhjalmur Stefansson

Prepared under direction of the Chief of the Air Corps, United States Army

The Macmillan Company, \$3.00
556 pages, 16 pages of illustrations

AT a settlement in the Mackenzie District not long ago a man who had been a resident of the country for a decade took occasion to denounce Stefansson, declaring that his books were inaccurate and gave a distorted view of the Far North. "By way of contrast," said the critic, "I want to recommend a book put out by the United States War Department. *Arctic Manual* it is called, and, although it is anonymous, whoever wrote it certainly knew the answers. It is a valuable handbook for anyone interested in the Far North, and indispensable for anyone going on an Arctic expedition."

Having quietly listened to this statement, I remarked: "Yes, quite true, and it happens that the author of the book is Vilhjalmur Stefansson."

All the Stefansson critic could manage to say was, "Well, I'll have to give the devil his due."

Soon exhausted was the original War Department edition of *Arctic Manual*, prepared for the guidance of men who wanted to travel or live in the Arctic, whether under conditions of peace or war, but with special reference to the needs of the Army. It is therefore fortunate that arrangements could be made for its commercial publication. And this new edition carries the name of the author, which will prevent its becoming a booby trap for other Old Northerners.

The table of contents indicates how rich and well planned the book is. Chapter headings are: Historical Background;

Continued on page 334

NATURAL HISTORY, SEPTEMBER, 1944

ANT DAIRY



By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON

LONG before men domesticated animals and learned to use their products for food, ants were keeping other insects, much as a farmer keeps his milch cattle. The best known of these insect "cattle" are plant lice or aphids, and one doesn't have to travel half way around the world to see them. You may observe ants and their herds in your garden, on the weeds along the roadside, or on trees in city parks.

Not all ants keep aphids. Some species of ants are strictly carnivorous, and others feed only on the fungus they grow in their underground gardens. But many of our common ants do drink the honeydew produced by these insects, and a few kinds depend on it almost entirely. An ant that is "milking" plant lice passes back and forth among them. It will stop near one of the feeding insects and stroke it gently along the abdomen with its antennae. The aphid releases a drop of the honeydew, which is eagerly imbibed by the ant.

Then the "dairy maid" moves on to another of her "cattle" and then another, repeating the gentle stroking. Three or four drops are enough to distend the ant's stomach and it returns to the nest.

Plant lice in the aggregate feed on almost every sort of plant. They are small, green, brown, black, or even red insects, soft-bodied and sacklike, with slender, piercing and sucking "bills." They are most often seen near the ends of twigs or shoots, or on the under side of leaves, but some live on roots underground. They bore into the sap-bearing tissue of the plant and drink steadily, and do not move around much.

The sap is rich in sugars, and the plant lice, although they grow rapidly, do not make use of more than a fraction of this sugar. The rest passes through the insect, partly digested, and is excreted. This is the honeydew, colorless and sweet, which may cover leaves or even the sidewalk underneath a tree. A single aphid may produce honeydew several times its own weight in a single day.

Plant lice seem to suck less juice from a plant and to excrete less honeydew when left to themselves. Stimulated by the ants, they produce generously, and instead of propelling

the excretion in a spurt, they release it gently for the ants.

In return for this valuable food, ants protect and take care of the aphids, which are soft-bodied insects and have numerous enemies. Two of their chief enemies are the so-called aphid lions—larvae of the lace-wing flies—and the young of ladybird beetles. When one of these predators appears in the vicinity of the plant lice, the ants rush to the defense of their "cattle." With mandibles open they charge the intruder, or shoot jets of formic acid in its direction if they happen to be species that are equipped for chemical warfare. Other aphid-keeping ants, when danger threatens, carry away their charges to safer grounds. Certain ants build protective sheds on plant stems to shelter their plant lice. Those that attend root-aphids excavate tunnels along the roots where the plant lice are stabled, each with free access to food.

Not only do ants take care of the adult, honey-producing plant lice, they gather the eggs of these insects in the fall and store them in their own nests during the winter. When spring comes the newly hatched plant lice are carried out to pasture on tender shoots or roots.

Physical Geography; Climate and Weather; Light in Polar Regions; Animal Life; Vegetation; Shelter, Heat and Light; Food and Drink; Clothing and Personal Equipment; Health, Accident and Disease; Travel; Transportation; Hunting and Fishing; and Mechanized Transport. There is a concluding section on snow-house building, with illustrations.

Arctic Manual is the only work of its kind in existence. It is, of course, a "must" as a handbook for any Arctic traveler. But its information is so entertainingly presented that anyone only casually interested in the Arctic may read it from cover to cover as easily as Stefansson's fourteen other books. RICHARD FINNIE.

THE ROMANCE OF EXISTENCE

----- by Ross Bundy

Pitman Publishing Corp., \$2.00

THIS book is an attempt to encompass the vast complexities of man's relation to the universe within the narrow space of 188 pages. It marshals together the outstanding facts and theories of astronomy, geology, organic chemistry, biology, and ontology into an impressive and uniquely worded prose poem, which has as its keynote the eternal mutability of all things. Unlike Alexis Carrel's *Man the Unknown* or Edwin Conklin's *Man: Real and Ideal*, it makes no attempt to suggest solutions to the ever-increasing burden of problems modern man is imposing upon himself, but contents itself with letting the cosmos tell its own story with the author acting as mouth-piece.

Like other popular treatments of a similar subject, the book follows mainly the genetic sequence which starts with planetary particles and ends with the mind and nature of man; but, because of the semi-poetical manner of presentation throughout, the eleven component chapters must be viewed more as stanzas of a poem rather than topical divisions. Nevertheless, a continuity of thought and aim runs unflinchingly from cover to cover of this unusual book.

Throughout its pages the author, Ross Bundy, stands revealed as a man of scholarly and philosophical approach who is broadly familiar with most fields of natural science and their latest factual and theoretical contributions. He is also revealed as a lover of beauty, quick to measure scientific truisms in terms of the human heart as well as find an emotional content in what others would prefer to leave as cold facts.

Another characteristic of Mr. Bundy is his familiarity with new words and his joy in using them as new dressings for old ideas. Still not satisfied with this, he goes even further and invents words of his own, which drive the conscientious reader to many futile trips to the dictionary. Examples such as "mirrophonic," "pansychism," "necropticeless," and "neonisms" are here offered as some of the most outstanding; but, while many of these lend a certain charm and force to what is said, it cannot be denied that

others seem unnecessarily forced and lend a note of freakishness and unreality to what should be an effortless and natural expression.

To use one of his oft-repeated terms, Mr. Bundy is "neophytic" in the field of literature. He makes no claims for himself as a scientist and modestly confines his own opinions to the background. Nevertheless, in *The Romance of Existence* he has produced a book which everyone with an inquiring mind should not fail to read.

GEORGE H. CHILDS.

STUDIES IN THE ANTHROPOLOGY OF OCEANIA AND ASIA

--- Edited by Carleton S. Coon and James M. Andrews IV

Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University XX. 220 pages, 20 plates, 10 maps and 6 figures. Cambridge, 1943.

THERE is no better way of judging a teacher than by the works of his students. In the present volume a group of the late Professor Rolland B. Dixon's former students make it clear to everyone that Dixon, besides being an outstanding scholar, also was an inspiring teacher. His wide field of interest is reflected in the subjects of the 14 articles of which this book is composed. With a few exceptions the articles directly or indirectly tie in with Dixon's own scientific production or his field trips, in spite of the fact that they cover a territory from Easter Island to Siberia and Arabia. Practically all branches of anthropological science are represented.

Each of the articles contains valuable information, but space unfortunately restricts us here to a brief word on a few of the topics that seem to have the greatest general interest. Shapiro's study of "Physical Differentiation in Polynesia" is based upon certain cephalic dimensions and leads him to the conclusion that the successive immigrants to Polynesia were derived from a common people, and that the differences in these particular cephalic dimensions were already established before the immigration took place.

A difficult problem "The Racial Elements of Melanesia" is attacked by Howells. He does not pretend to have solved the problem, but suggests the following sequence of immigrants: 1) the Australian Aborigines, 2) Negroites, 3) a series of Negro peoples who mingled with the former occupants and 4) influences from Polynesia and Micronesia.

Linton's article on "Cultural Sequences in Madagascar" is very interesting, and with the scanty evidences that are available he gives a very sensible explanation. His sequence is: 1) Negroid pygmies in a food-gathering stage, 2) brown-skinned agriculturists affiliated with Indonesia, approaching the island from the north where they gradually obtained Negroid admixture, 3) later, more Mongoloid immigrants from Indonesia with new culture traits, like irrigation, weaving, and possibly pottery; and finally 4) the Arabs.

Gaul's article: "Observations on the

Bronze Age in the Yenesei Valley, Siberia" is based upon Teplouhov's important works, which are indispensable to the student of Eurasiatic Archaeology, but were hitherto inaccessible to students not familiar with Russian.

HELGE LARSEN.

OIL IN THE EARTH

----- by Wallace E. Pratt

University of Kansas Press, 110 pages

HERE is an excellent little book based upon four lectures given before the students of the Department of Geology, University of Kansas, the alma mater of the author. For this, the second edition, the original subject matter is said to have been revised, rearranged, and amended, thus bringing it down to date or to the consideration of problems correlated with the present World War. The author is an expert oil geologist with an experience of more than 30 years in search of oil in the far corners of the earth. Consequently he writes with authority. Furthermore he gives us a clear elementary discussion in a manner fascinating to the layman, and, we believe, with real interest to the professional. The author is now Vice-President of Standard Oil Company (New Jersey).

In the first section of the book, titled "This Is Oil," he discusses briefly the nature of oil and its origin from marine creatures buried in the muds of the sea; the relation of gas, oil, and bitumen; the nature of oil pools; and how oil migrates. He then formulates a few principles for guidance in exploration.

In the second section, "Where Oil Is," it is explained how oil is found in porous, marine rocks in proximity to shales or lime-stones rich in organic matter, where it is trapped between impervious beds above and heavy brines (fossil sea water) below. While oil is a normal constituent of the marine sedimentary rocks all over the earth, the two greatest areas so far discovered are the Gulf of Mexico and Caribbean Sea region and that of the Near East, the latter now being the best hunting-ground for oil on earth. The Lake Maracaibo basin of western Venezuela has been described as the richest source of oil in the Western Hemisphere.

In the third section, "Who Finds Oil and How," there is an interesting discussion of how it has come about that Americans have found more oil and developed oil resources more rapidly and extensively than other peoples.

The fourth and last section is titled, "Whose Oil Is It?" In this the author outlines a future oil policy for all nations, based upon the experience of the past.

CLYDE FISHER.

DOWN TO EARTH

----- by David Greenhood

Holiday House, \$4.00

262 pages, 228 illustrations

IN his book "Down to Earth" (Mapping for Everybody), David Greenhood does just what his title implies. He pre-

sents a study of maps, their history, construction, and purposes in such a way that those who are trying to find their way over and around this earth of ours may learn a little more about the maps on which they rely for guidance. It is gratifying to map students and collectors to note the current interest in this subject, which has long been confined to all too small a group.

The author's language is simple but effective, and his presentation a logical and useful one. The subject matter is presented in three parts: Part I, entitled "Getting the Most Out of Maps," gives a general description of map projections and their uses; Part II "Making Your Own" personalizes and humanizes maps, for it encourages the layman to set about making his own maps for his own particular needs. There is practical, common sense advice here for anyone who wishes to make a map. The key to the situation lies in learning that a map is not a jumble of complex lines, but a means to knowing the world you live in, once (to quote the author) "you begin to visualize it on paper."

Part III "Forming a Collection," treats of treasures, tools, materials, and equipment for the one who wishes to start a map collection of his own. The point is well stressed that a collection should have a purpose, a theme, if it is to be justified. If we read between the lines correctly it would appear that the author's own interest in maps probably started with his own experiences in gathering a collection of maps for some particular purpose.

The general content of the book is complete and comprehensive, and gives a good over-all picture of the essential facts we really need to know about maps. There are also a number of helpful suggestions of other books to read to improve our background in cartography and lists of sources from which to obtain various kinds of maps. The appendix contains some very helpful tables of figures and measures, and there is a good index. The black and white illustrations, by Ralph Graeter of *Life Magazine*, are well chosen to enhance and explain the textual material.

Whether you are a mere novice or an old hand at map-study, you should find this book interesting. The author is to be thanked for his part in the campaign to arouse interest in maps and to help the reading public gain some idea of the fascination that lies within the folds of a map.

IRENE F. CYPHER.

THE FORT ANCIENT

ASPECT: Its cultural and Chronological Position in Mississippi Valley Archaeology

- - - by James Bennett Griffin

University of Michigan Press, \$6.00
376 pages, 185 illustrations and maps

THIS is a formidable volume and highly technical. Yet the general reader trying to keep abreast of the fundamentals in the archaeology of our homeland should be interested in the following comments. As a scientific contri-

bution the value of the book is outstanding, but it may not be readily recognized that by use of the latest methods in archaeological science, existing data are so organized as to bear upon a few important simple questions. If Indians built the great mounds in the Ohio River basin, which of the surviving tribes are their direct descendants? The two previously proposed answers are, (a) that a Siouan people built the mounds, (b) that a Shawnee, Algonkin-speaking group, should have the credit. The author concludes that neither of these answers is probable, nor does he feel that the evidence warrants another guess.

The two most impressive earthworks in Ohio are Fort Ancient, massive embankments enclosing more than 100 acres, and Serpent Mount, a realistic masterpiece of earth sculpture representing a crawling snake over 1300 feet long. A type of ancient culture ("aspect" in classificatory terms) which once spread over a large part of the Ohio valley, is designated as Fort Ancient, because its type site is adjacent to the "Fort," yet it happens that the dwellers at this site can make no claim to the "Fort," nor was the Serpent Mound, some 50 miles distant, built by them either. Chronologically, Fort Ancient culture was preceded by what is known as Hopewell culture, whose devotees certainly built both the "Fort" and the "Serpent." So the author concludes that it was a later culture, which established one of its main villages outside the abandoned, ruined walls of the "Fort," to which the term Fort Ancient Aspect applies.

C. W.

MANY HAPPY DAYS I'VE SQUANDERED

- - - - - by Arthur Loveridge

Harper & Brothers, \$2.75
278 pages, 19 half-tones

THIS interesting autobiography of a naturalist carries the reader from the British Isles to Africa and eventually to the United States, and in all these places the author takes an active part in studying the wildlife about him. He is one of those rare individuals, born to a career in natural history, who began at an early age to observe the creatures about him and who has been able to make this interest his life work. Considering the importance attached by Loveridge to the study of natural history, one might wonder at his choice of the word "squandered" in the title of the book. Perhaps this word was used in recognition of the rather prevalent reaction of the lay public to many of the activities of a naturalist. Strangely enough, however, the British officers warring against the Germans in East Africa displayed great patience

with the boundless enthusiasm of Loveridge who, despite the war, never missed a chance for a specimen.

This was during the First World War and the campaign took the author into regions abounding in various forms of life. Loveridge is primarily a herpetologist, but his experience and knowledge are broad enough to make him a competent observer of mammals, insects, birds, and other creatures. Little went on that escaped his attention. Although he is a collector of museum specimens, he shows great sympathy for the living animals, and the pets he has had would make a fair start for a zoo. Apparently he has a way with animals and they respond to his attention.

This book has a dual attraction. It will make its greatest appeal to the student of wildlife because of the great amount of field observations, but it will also score as a simple, straightforward story of a vital and enthusiastic individual.

H. E. ANTHONY.

THE STORY OF THE AMERICAN INDIAN

- - - - - by Paul Radin

Liveright, Philadelphia, New York, \$1.98
391 pages, 30 illus.

THIS is a reprint of a former edition, with 6 illustrations in full color and 24 in black and white. The theme of the book is that the center of culture influences shaping Indian life were diffused

Adventures of a naturalist whose life has been "one long holiday"

Many Happy Days I've Squandered

By ARTHUR LOVERIDGE

Curator of the Museum of Comparative Zoology, Harvard University

"ARTHUR LOVERIDGE decided, at the age of ten, that he would become a Museum of Natural History Curator when he grew up. Happily, both for Mr. Loveridge and for us, fate permitted him to follow his desire. The result is a collection of reminiscences which make delightful reading as well as providing important field notes on collecting . . . it records many strange tales of the odd ways of animal or insect."

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from Middle America and the Andean highlands. This idea is not original with the author but is presented in the convincing manner of initial insight. The dynamic style approaches that of Prescott. The reader may be intrigued by the closing chapter, which points to Mexico as the most probable country to witness an Indian Renaissance, in which "the Indians may see so much of what they prized incorporated in the new civilization whose manifest destiny it clearly is to direct us toward the only road that can give us happiness, security and the proper sense of human dignity." The author believes Mexico the only country capable of a come-back of the best in Indian culture.

C. W.

SIERRAN CABIN . . . FROM SKYSCRAPER

----- by C. M. Goethe

Published by the author,
Printed by The Keystone Press,
Sacramento and San Francisco, California
185 pages, 46 photographs

THE author, who is evidently an all-around naturalist, calls the book "A Tale of the Sierran Piedmont." In the last paragraph of the foreword, he says, "This history, then, is that of one certain Skyscraper Man, Charles Allen. Allen was astute enuf to escape systematically from his Skyscraper in Sacramento to the nearby Sierran piedmont. In these foot-hills he found recreation that was Re-creation." As one reads the little volume, he begins to suspect and gradually to become more sure that "Charles Allen" is the author, that it is an autobiographical tale.

There are 25 short chapters consisting of episodes on all phases of the natural history of the region treated, from its geological origin and development to the plant succession. The stages in this history are very often correlated with historical events in other parts of the world. In all his observations, the author has in mind their bearing on the great biological principles of evolution,—struggle for existence, co-operation, and survival.

Over and over there are pointed out lessons to be learned from the plant and animal world that may be applied to Eugenics, the Differential Birth Rates Law, and related topics.

The book is remarkably free from errors, but the reader might be led astray by the statement that the trees of the Petrified Forests of Arizona are araucarias, followed by the statement that this "pine" today is found only in Chile. These fossil trees are not placed in the genus, *Araucaria*, but in a related genus, and they are extinct everywhere. Living representatives of the genus, *Araucaria*, however, are still to be found in Chile, Norfolk Island, New Caledonia, and Australia.

Nearly 50 interesting photographs illustrate the volume. The author's knowledge of the many fields of nature and his familiarity with the woth-while nature literature add much to the interest of his story.

CLYDE FISHER.

INDEX FOSSILS OF NORTH AMERICA

----- by Hervey W. Shimer and
Robert R. Shrock

John Wiley and Sons, \$20.00

(A Technology Press Publication)
837 pages, over 9400 illustrations

THIS encyclopedia of North American invertebrate paleontology purports to be a revision of Grabau and Shimer's *North American Index Fossils*, long out of print. But it differs so radically from that work in form and method of treatment that it must be considered as an entirely new, and on the whole more valuable, book.

It deals almost exclusively with the fossil invertebrates, devoting only a few pages to some selected plant types, and does not discuss any of the vertebrate index fossils; in this respect the book is mis-titled. However, it must be recognized that the invertebrates are by far the most abundant and widespread fossil forms, forming a group of such magnitude that their discussion in any one book is a monumental undertaking. The present volume includes more than 7500 species, giving more than 9400 illustrations on 303 plates (300 devoted to invertebrates, 3 to plants).

Many specialists assisted in the preparation of the volume; some chapters were entirely written by other workers, and all were critically read by such students. Invertebrate paleontology has become a complex of specialized fields beyond the critical knowledge of any one individual, and such treatment is essential in the preparation of a completely reliable text. Another aspect of increasing specialization is reflected in the constant subdivision of generic and specific units, and the genus has assumed an importance for geologic correlation similar to that held by the species during earlier days. As a result the generic unit is the most important element in the present work, whereas Grabau and Shimer stressed specific units.

The usefulness of the book is apparent: for the paleontologist it will be a guide to groups outside the field of his speciali-

zation; for the stratigraphic geologist it will be a dictionary for ready identification of fossils and determination of geologic horizons; for the "amateur" whose interest in fossils lies in their collection and study, it is an indispensable tool, and a "must" for his paleontologic library.

H. E. VOKES.

OLD ORAIBI, A STUDY OF THE HOPI INDIANS OF THE THIRD MESA

----- by Mischa Titiev

Papers of the Peabody Museum,
Harvard University
277 pages, 26 illustrations

THE Hopi Indians make a strong appeal to the American imagination because of their spectacular snake dance and pueblo ways. Old Oraibi is one of their best known villages; the tree ring date for a beam in one of its house units is 1150 A.D. This is 342 years before Columbus. In 1906 dissensions arose in the town, then composed of 150 households and about 600 people, resulting in the founding of a New Oraibi and several other villages; yet Old Oraibi still survives. The author gives the history of the village since its discovery in 1540, giving especial attention to the causes for the split-up in 1906.

Yet the main part of the book deals with the social organization of the village, its form of government, the main ceremonies and their meanings. While the text deals with technical subjects, the essential facts and interpretations are presented in clear simple language. A typical household is carefully analyzed to show the relation of each individual to the other. A type of matrilineal family exists in which the females continue to live in the house of their birth and their husbands come to live with them.

The present World War has set us all thinking about democratic government and personal freedom: we are sure that the simple clear presentation of how the Hopi govern themselves will be a stimulating example of how some primitive people seem to have achieved these blessings.

C. W.

THE WAY OF A COON

Continued from page 311

tony, a layer of fat spread itself beneath his skin and over and around his internal organs—spread and thickened from day to day until he became almost cylindrical in outline, weighing perhaps ten pounds more than in early spring.

By mid-November, a strange lethargy had also assailed him. He felt less urge to hunt and run and climb, and food now seemed less desirable. His nightly runs became shorter, and he drowsed for longer periods, sometimes on a bad night failing entirely to leave his den in the oak. Once he remained there for three whole days, but ended

this by a short run the next night.

One evening in early December the wind whistled bleakly past the entrance to the coon's den. Rousing himself by a kind of desperate intent, the coon climbed to the entrance, looked out into the night, and slowly sniffed the raw air. But he got no further. The fat of his heavy body was drugging him, and an immense drowsiness overwhelmed him. Gone was all desire for food or hunting or a run in the dark. Slowly he slid back into the depths of the old tree and passed easily and unknowingly into the dim quietude of the winter sleep of his second year. It was the way of a coon.

LETTERS

Continued from page 295

over the South Polar regions differ greatly from those over the North Polar area, which were the ones cited in the article. Before extensive observations had been made of conditions in the Antarctic, it was quite usual (though, as later learned, not justified) to assume that conditions there were similar to those in the Arctic. But observations made since 1938, particularly those of the U. S. Antarctic Expedition of 1939-41, have shown a much wider range of stratosphere temperatures in the South Polar areas than any so far observed in the Arctic. These observations were made at Little America III, the west base of the expedition, a few miles from the Little America which Admiral Byrd made famous in 1928 and 1934, about 800 miles from the South Pole.

From these soundings and other recently-acquired data, it appears that, over the South Pole in late winter, when no sunlight reaches the atmosphere at all, temperatures decrease steadily with height and may even approach absolute zero somewhere between 50 and 250 miles. Still higher it grows warmer as the region of perpetual sunshine is reached at 310 miles. Thus Doctor Stocking's statement, which may be strange to many people, that at a height of 12 miles it can be warmer over the poles than above the equator is not necessarily true as regards the South Pole in winter, though it applies there most of the year, and, as far as observations go, all year in the Arctic.

These same differences in temperature between the Arctic and Antarctic probably indicate similar differences in other characteristics of the stratosphere, such as the ozone layer and the Appleton and other radio transmission layers, which have not been investigated at all in the South Polar regions.

ARNOLD COURT.

Seattle, Washington.

INSECT-TRAPPING FUNGUS

The discovery of the first fungus known to trap and destroy insects is announced by the Agricultural Research Administration, U. S. Department of Agriculture. The fungus is of the type that sends out horizontal threads or hyphae that criss-cross and actually join at the intersections to make a network that may be likened to a piece of electrically welded wire fencing in miniature. This network sends up columns that exude droplets of a clear adhesive liquid at the top, forming the deathtrap for the insects. Once caught, the insects are run through with a cobweb of filaments that transfer the food elements from their bodies to the fungus.

It is a microscopic soil-inhabiting fungus

said to be "unmistakably adapted to prey primarily on insects" and "under natural conditions presumably is given wholly to a predaceous mode of life."

Dr. Charles Drechsler, who made the discovery, states that although there are over 60 fungi known to capture animal organisms such as amoebas, nematodes, rotifers, and other small forms, this new one (*Arthrobotrys entomopaga*) is distinguished by the fact that it catches spring-tails—insects that jump by means of springy near-end spines.

PIGEONS IMPORTANT IN WAR STRATEGY

An increasing use of pigeons for carrying messages in the Southwest Pacific is revealed through the Australian News and Information Bureau in a statement issued by the Army. An Australian Army Pigeon Service was started early in 1942, and pigeons are now carrying 7,000 to 8,000 messages a month. The service has become so important that all Australian troops are instructed in the use of the birds.

During early stages of the New Britain landing, one Australian survey patrol equipped with pigeons, 24 miles from its base, sighted a body of enemy troops. A pigeon took a message back in 22 minutes, which made it possible to hold the position.

Small ships without radio rely solely on pigeons for communication, and other vessels use pigeons when it is undesirable to break radio silence.

STARRED SCIENTISTS

In addition to the many other members of the Scientific Staff of the American Museum already enjoying this distinction, four more names are newly starred in the latest edition of the scientific "who's who," *American Men of Science*. The men who have recently received this special distinction are Harry L. Shapiro, George G. Simpson, C. M. Breder, Jr., and Ernst Mayr.

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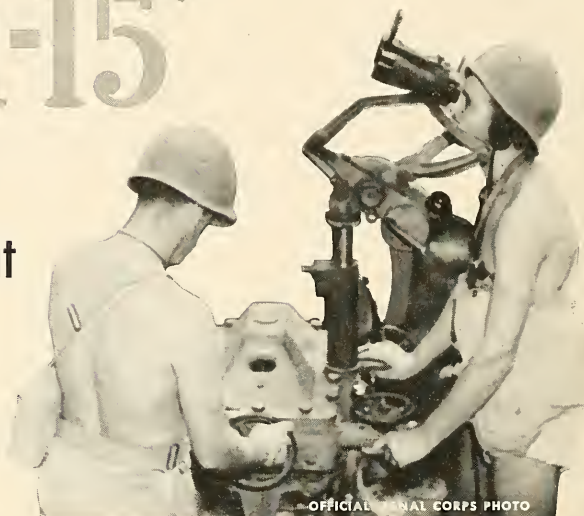
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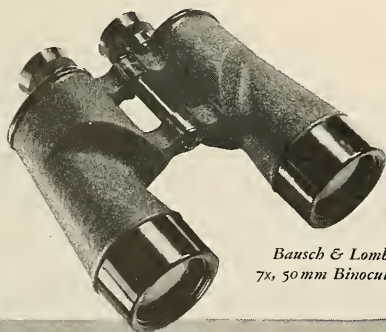


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October **NATURAL HISTORY** *1944*

Australia • Wet Lands & Dry Seas • Fishing Cats

Parícutin Comes of Age • From Staples to Spices



MORE TIKIS

Last year, when we advertised the LOST TIKIS, we felt we would not see any more until after the War. However, much to our joy, Mr. Martin Anthony Brunor informs us that he has received another shipment. Unfortunately for Mr. Brunor, the natives of Tahiti neglected to polish them and he found himself burdened with the laborious job of polishing. Personally, we feel that he has done as good a job, if not better. Mr. Brunor is returning to Tahiti, lucky man, sometime in February, and promises

to come back to us in 1947 with a shipload of wonderful surprises. No matter how many years it takes to get them here, we shall always be fascinated with the primitive art of Tahiti, the beautiful rosewood and cordia wood from Nuka Hiva, and the mystery of the Taa Roa, Lord of the Ocean.

We also have Traditional Female Heads, made by Tu of Papeari (Water of the King), and assorted bowls made of cordia wood and Puaa Rata.

TIKIS

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LETTERS

SIRS:

I am sending a snapshot taken at the famous canyon in Utah known as the Goosenecks (See *NATURAL HISTORY* for May, 1942). No, the visitor is not scared. On this particular day the atmosphere was so heavily charged with electricity that it caused one's hair to stand on end. The electricity would snap and crackle on the finger tips of an extended hand as depicted by my friend Ray Barnes of Redondo Beach, California.

As an amateur fossil collector I find your articles on geology and prehistoric life easy to comprehend, most instructive, and intensely interesting. I enjoyed a great deal the articles on the Devil's Tower, Parícutín, Meteor Crater, and Monument Valley . . .

CARL "BUCK" BLEIFUS.

Hollister, California



DEAR MR. CARR:

This is a line of thanks for your delightful tale of the Bear Mountain Bears.

I like many different kinds of animals and particularly bears, and yours are diverting my attention from the hurricane which is raging about me.

EDITH K. ROOSEVELT
(MRS. THEODORE, SR.).

Oyster Bay, N. Y.

SIRS:

I have to acknowledge with grateful thanks the receipt of the undernoted copies of your very excellent publication, *NATURAL HISTORY*, which unfortunately had been held up until conditions allowed for their safe transport across the Atlantic.

It is impossible for me to express the satisfaction felt by myself and my colleagues at the reappearance of *NATURAL HISTORY*, which is of absorbing interest and usefulness to us all. Speaking for myself, I look upon it as the outstanding publication of its kind and should like heartily to congratulate you and your colleagues on the production of a journal that can and does put forward scientific facts in a manner so acceptable to the interested amateur, and may I add to the professional as well.

The Editor,

THE IRISH NATURALISTS JOURNAL.

Belfast, Ireland

SIRS:

I am renewing my subscription to *NATURAL HISTORY* because I've enjoyed every issue I've gotten so far and would like to continue. I have been a taxidermist for a long time now, and these natural history books make my work more interesting. I do the taxidermy work in my spare time as a hobby. I love all outdoor life and everything about nature. Again I say, I love to read *NATURAL HISTORY*, and I'm getting my children interested in it, too.

JOHN J. PERZEL.

Raritan, N. J.

SIRS:

I subscribed to *NATURAL HISTORY* for the George Dixon Grammar School for Girls, Birmingham, England, and enclose a letter showing how much it is appreciated.

Is it possible that the Museum has half a dozen or so friends who would give a year's subscription to an English school? On this chance I am sending you a list of schools and their addresses.

THEO. D. A. COCKERELL.

Boulder, Colorado

Dear Professor Cockerell:

The first three numbers of *NATURAL HISTORY* have just arrived, following an advisory note from the Museum in New York last month. It is very kind of you to have arranged for this periodical to be sent, and I can only say how grateful we are to receive it. There are several points in each of these three books which have come up in discussions lately in my senior forms, and these informative and well-illustrated articles are therefore more than usually valuable at the moment . . .

LUCY GOSLING.

George Dixon Grammar School for Girls,
Birmingham, England

If readers wish to encourage English-American relations in the realm of natural science by providing a subscription to *NATURAL HISTORY Magazine* (foreign rate \$4.50), the Circulation Department will welcome the opportunity to send the magazine to one of the schools on the list supplied to us by Professor Cockerell. Direct your remittance with your name and address to the Circulation Manager, The American Museum of Natural History, New York 24, N. Y.—Ed.

Continued on page 340

Adventures of
LONGINES
THE WORLD'S MOST HONORED WATCH

The Navigation Watch of the Schooner Commodore

ON a bright September day in 1942, the schooner Commodore cleared the Port of Seattle . . . destination Durban, South Africa. More than a year passed before full details reached home of her adventurous 143-day voyage around the Horn. ¶ Low rations, mountainous seas and a two-day hurricane that took away half the sails were climaxed by the loss of the ship's Chronometer overboard early in the voyage. But she made port safely . . . navigated by a Longines strap watch belonging to one of the officers. ¶ "It was lucky I had that Longines watch," he wrote. Without any such need, thousands of Longines watch owners echo his sentiments daily. The feeling of security that comes from owning a competent watch, such as a Longines, is priceless.

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ALBERT E. PARR, Director

VOLUME LIII—No. 8

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OCTOBER, 1944

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COLOR PROCESS, BLACK AND WHITE, BEN DAY, LINE

Above Illustrations: Part of Plains Group, American Museum of Natural History. Photo by T. L. Bierwert and C. H. Coles



LETTERS

SIRS:

I am interested in your offer to attempt to establish the truth or falsity of certain nature stories. I have three which I should like to submit.

It is often said that the hummingbird rides a larger bird on migrations. He is usually accused of hitchhiking on a goose. Please tell me whether or not there is any scientific basis for this story.

We have a bird, very common here in Texas, known as the road runner or chaparral cock. Some people say that he often kills a full-grown rattlesnake. He wears the snake down, permits him to strike but receives the strike on the stiff feathers of his wing, and finally tires his antagonist out until he is powerless to resist and is then killed. Please let me know whether or not this story has any scientific basis.

We have a very capable nature observer here in Texas who says that she actually saw a praying mantis kill a hummingbird and proceed to eat its brains out. Has this observation been made anywhere else, and do you consider that it is a possible occurrence?

ROY BEDICHER,

The University of Texas, Austin, Texas

It is untrue that the hummingbird rides a larger bird on migration. This story is of great antiquity and has been given in connection with many small birds besides the hummingbird. The story probably arose before migration of birds was thoroughly known, and smaller species which migrated at night were seen one day and found absent the following one. The larger birds were seen migrating, and the rest was pure guesswork.

The road runner does kill rattlesnakes. I would not say that it permits the snake to strike but rather that it is able to avoid

Continued from page 337

ical News, Vol. 44, page 39, February, 1933. I have no way of ascertaining the validity of the claim or of knowing whether the bird was injured or ill before its capture. I have seen no other account of this procedure. Hummingbirds are captured by some of the large tropical spiders and have so been reported at various times, but a mantis is relatively so small in comparison with the bird that I am inclined to doubt the regularity or normality of any such occurrence.

JOHN T. ZIMMER,

Curator of Birds,
American Museum of Natural History,
New York, N. Y.

SIRS:

I have taken your Magazine for many years and I note that you are interested in photographs from readers. I have collected insects and studied Nature since a very young man and have had many adventures in this line. However it remained for 1943 to produce the real highlight of my insect collecting. Right at home I came upon this freak of Nature.

One Sunday morning in September I was roaming the school yard next to my home with my camera in hand when all of a sudden my eyes lighted upon a specimen of *Colias (Eurymus) philodice* which to my astonished gaze seemed to combine the wings of both male and female.

Its flight was not quite as strong as usual, but I didn't have a net. Fortunately my son Lester was close at hand with some other boys, and I yelled to him to get my net, for I had the prize of my career in front of me. He did so, and after one false swipe, in which I caught the net on a briar, I landed my prize and took it into the house, where I spent quite a period admiring its queer structure.

As the print will show, the right-hand



ON THE LEFT is the male, on the right the female. In the center is Mr. Harry L. Johnson's curious intermediate form.

the striking reptile on most occasions and that if struck on the wing feathers, it would not be harmed. Probably no very large snakes are killed in this way, but the bird is fearless, at least with smaller members of the rattlesnake tribe.

The report of a hummingbird captured by a mantis was published in *Entomolog-*

side has the female pattern while the left-hand side is distinctly male. The right wings are white and black [representing the albino condition, not uncommon in the female of this species] while the left pair are bright yellow and black. I understand that this is known as a gynandromorph. Close examination will show

Continued on page 384

Make Autumn COLOR Your Own

By THANE L. BIERWERT

Acting Chief, Division of Photography,
The American Museum of Natural History

Cool weather is here again. There is a bit of a nip in the air, and it invigorates you. A walk over the countryside instills an enjoyment of autumn and its coming change of foliage among the trees. There is a thrill in watching for the first signs of transformation and noting the gradual acceleration of color changes.

You might think that there is little of natural history to photograph at this time of year. The flowers are gone; snakes, frogs, salamanders, toads, small mammals, and birds have either crawled in or migrated to escape the rigors of winter and its food problems. But if you really look for subjects, they are almost as numerous as those of spring. The most evident subject, autumn foliage, fairly screams at us from every side. Its brilliance and its subtlety offer you the opportunity to make an interesting photographic story. Harder to find are the fruits of many trees, shrubs, and flowers—without which, the life histories of plants are not complete. Near the ground are found the multifarious forms of lower plant life, lichens, fungi, mosses, and liverworts. In fields and along roadsides you can find the rosettes of many biennial weed plants from now until spring. And, of course, who ever has to look for beggar-ticks, burdocks, tickseeds, or pitchforks? These love to attach themselves to you and to hitchhike on woolly clothing!

Autumn is a challenge

The color films—Ansco-color, Kodachrome, and Kodachrome—are the only films to use. They capture the delicate tints and the vivid hues and hold them for you and your friends to enjoy all year around. There is no greater pleasure than setting up projector and screen and reliving the autumn on a cold winter's evening. Hillside of glorious color can be spread out on the screen. Close-ups of horse chestnuts and milkweed pods can be "blown-up" to their full beauty. Once color photography gets in the blood, you can never rid yourself of it.

This year, how about making a lapse-of-time series of color shots? If you have a movie camera, that's excellent, but it can be done with a still camera just as well. First select a vantage point looking across a small valley or gulley toward a hillside that has on it dogwoods, sweetgums, sassafras, maples, oaks, or other trees that will have changing foliage, as well as evergreens. Naturally not all these trees need be there, but the greater the variety, the more interesting the series. Mark your spot with a stake. Here is the location for all distant views. It is from this point that the general change of color will be photographed. Open the series with a shot showing a green hillside, a mixture of light and dark greens of deciduous and evergreen. If you can get an early-turning dogwood all by itself against the green background, you are

off to a perfect beginning. (My own most highly prized autumn Kodachrome is one like that.) As the days go by, make more exposures from this same location. Take care to include exactly the same view each time, because later when you show the transitions on the screen the effect will be much more impressive if the skyline doesn't jump around. Try not to miss any of the gradual changes, otherwise a one year's wait is necessary! Enlist the aid of some member of the family or a friend who is as interested as you to photograph during the week if work requires that you be in town. Eventually the time will come when the deciduous trees will stand brown and somber among the constant dark green of the pines and hemlocks.

Such a series has another purpose, more important than to show gradual foliage changes. It sets the scene for medium shots and close-ups made on the same days. Here is where the real pleasure begins. Roam around, not necessarily on your hillside, but everywhere that there is something of interest. Look for dogwood berries, a branch well-laden with the red fruit among the green, yellow, and reddish leaves. Find a low branch of a beech tree with its golden leaves; try for a bit of composition to show how the twigs branch, and include the beechnuts if any are found before the squirrels get them. Send your son or the neighbor's boy up an oak tree to cut off a branch bearing acorns. Have you ever seen the fruit of the ginkgo? Did you know that the witch hazel flowers at this time of year? These scraggly, yellow-ribbed flowers open long after other trees and shrubs have blossomed. Quite often the flowers and fruit can be photographed on one branch. Move in close, because both are small. These are but a scratching of the surface of what can be done. Use your own judgment when to stop. Really, you can scarcely have too many close-ups; almost everyone prefers to see crisp, clean close-ups to long shots of masses of colors.

Don't neglect the near-by fields with the milkweed pods and their soft downy "parachute" seeds, the green hooked, sticky, clinging burdocks, the never-letting-go beggar-ticks fastened to sweater sleeve, skirt or pants leg, the proud thistle heads, the ground-hugging rosettes of mullen, thistle, and dandelion, and the dozens of other prosperous weeds. They, too, are a part of the story of autumn foliage even though you might not think so.

Your color slide audience

By the time that you have expended several rolls of film on these subjects, you should have enough slides for a real show. Arrange the slides in chronological sequence, grouping them with the long shots to head each definite section. Identify your specimens and mention the dates when they were photographed so that your listeners will realize that you worked more than two week-ends. Your audience will then be aware of the definite pattern that all plant life follows as it prepares for wintering-over.

There are a few things to think about before making these color pictures. Take your time; the subjects will not run away while you are making up your composition, and is not easy to crop after the exposure has been made. For best results, long views and medium shots are best made on clear, contrasty days if you want strong color; close-ups often call for diffuse sunlight. However, remember that some of the most striking results are attained by breaking the rules and shooting "into the light," and by recording distant views on hazy days. If you own a Pola-screen, by all means use it. This accessory will darken skies, strengthen clouds, and cut sky reflection from leaves, thereby enhancing the hue of the foliage. It will minimize haze and reduce glare from water. Try some exposures with and without the Pola-screen. (Don't forget the 2.5 times normal exposure factor!) And remember the tripod, exposure meter, and notebook.

There isn't much left to do but go out and photograph. Here's to a marvelous set of pictures! I hope the weather treats you right.

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be glad to try to answer them.—ED.

THE COVER THIS MONTH

The tree frog on the cover was photographed in late September or early October, by Henry B. Kane. These amphibians are called peepers, because their chirping chorus is at times so noticeable in the lowlands. "Many persons," writes Mr. Kane, "look askance at pictures of peepers on twigs or trees, saying with assurance that the creatures live in the water. Tree frogs enter the water in spring to mate, of course, but leave again in May or June in New England where this picture was taken. They hunt through low shrubs and grasses from then until frost. I have found them at heights as high as my head, although I believe they usually hunt through lower vegetation."

Their climbing is made possible by adhesive discs on the tips of fingers and toes. The family to which the tree frogs belong (Hylidae) is a large one, embracing about 300 species, of which about 250 belong to the genus *Hyla*. They are distributed widely throughout the world, and in the United States are often called tree toads. They deposit their eggs among fine grass or other vegetation on the bottom of the pond, where the tadpoles pass their larval life—ED.

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PARÍCUTIN COMES

By FREDERICK H. POUGH

*Chairman and Curator,
Department of Geology and Mineralogy,
American Museum of Natural History*

ON its first birthday, February 20, 1944, a number of scientists and friends of Parícutin were on hand to celebrate the occasion properly, but the volcano disappointed them by not performing in any unusual manner. It was too bad for those who had taken the trouble to travel the 200 miles from Mexico City for the event, but one can hardly expect a one-year-old infant, even though it is 1200 feet high, to appreciate the importance of the anniversary and to disport itself in a fitting manner.

In spite of the disappointment of that occasion, however, Parícutin has for the past year behaved in a manner to justify the interest and the inconvenience of the journey. Parícutin volcano has treated that part of the state of Michoacán to a generous display of fireworks all through the year, and it continues to be an obstreperous and unpredictable infant. The early interest of scientists in the phenomenon has been more than justified by the subsequent developments of the volcano, and those early prophets who thought it would be dead before twelve months have been thoroughly confounded. Just how much longer it will be active is still anyone's guess. We have only the record of its older brother Jorullo to go by, a volcano that is reported to have stayed in eruption for nineteen years.

There have been many changes in the countryside since the American Museum's first expedition to the volcano, and on our second visit last March it was at times difficult to recognize the same spots seen previously. The second expedition, a far more ambitious one, was sponsored by Dr. Otto O. Fisher of Detroit, and the personnel included Dr. Clyde Fisher, Te Ata, Capt. F. Hugh Defendall as pilot, and the writer. Several members of the University of Michigan accompanied the party in a companion expedition, and Lt. Col. Ray H. Baker of the Detroit Civil Air Patrol piloted his private plane so that the members could fly over the volcano and observe it from the air. Our first impression was that the intensity of the eruption had greatly

diminished, but it was not long before that idea was dissipated by closer observations. The countryside showed the effects of the continuous fall of ash, especially in the towns of San Juan de Parangaricutiro and in the nearer Parícutin. Last year, when the town of Parícutin was first seen there was only a foot or so of ash in the streets, little more than enough to cover the sills of the doors. By March of 1944, the ash had reached nearly to the tops of the doorways, and it continues to rain down. It is now possible to ride over much of Parícutin without knowing there is any town there at all. The church roof has broken down entirely, and ash fills the interior. As if in final recognition of their helplessness in the face of nature's forces, the villagers removed the bells which formerly stood in front of the church, and today it is a completely dead village. Even San Juan has become untenable and by now is completely abandoned.

The ash-covered fields and forests are mantled ever deeper by the steadily falling rain of ash, but the tourist and native now have far greater discomforts than result directly from the ash showers. During the dry season the sun reflected from the gray and barren fields soon stirs up convection currents which make a daily wind storm, and the scurrying gusts pick up the still unsettled dust and give it yet another journey, hither and yon across the buried hills and valleys. From noon till five one can hardly see 20 feet ahead. The blowing clouds obscure the view, clog the nostrils, sift down the neck, slip into your watch and camera, and pepper your food. Life can be very trying under these conditions, and photography almost impossible. Indoors it is as bad as out, for the dust and sand seems to fill every nook and crevice, ready to shower down at the slightest jar.

The towering dust-devils which formed near the cone were spectacular additions to the volcano's sights. Once when we were flying above the cone, a

miniature tornado seemed to reach higher than the plane, which was flying 1500 feet above the summit. Often they seemed to be stationary, whirling away a mile a minute but hardly moving from a single spot. Then, gradually they would disappear, or creep up the cone, to be lost in the greater column of new dust from Parícutin itself. Being caught in one of these was not as unpleasant as might be imagined. We found the whirlers of coarser particles little more unpleasant than the daily dust storms; at least we knew we could step out of the cloud in a few minutes and be free to breathe again, not doomed to more hours of stifling before the sun would set and the winds die down.

The first impression was of diminished force, as if Parícutin, like the annually pictured year which goes out December 31, had become prematurely aged at an amazing rate. We noted a marked reduction both in the volume of the dust cloud and in the frequency and force of the explosions, and a diminution of noise. On first sight the volcano truly seemed to be far less active, and at no time, to tell the truth, did it equal the splendor of the sights observed last June, when incandescent bursts spread in a great Fourth of July flowerpot from the top of the crater, raining down on all sides in a million sparkling fragments. But then, on looking back, we realized that we had had our best display only one night, and for a few hours at that. The lightning flashes and their claps of thunder, too, were less often noticed on the second visit, though some of the party, who arrived one night earlier, reported frequent flashes then.

Few of the arching bombs cleared the base of the cone, but one should remember that the base of a 1300-foot cone is considerably larger than that of one 1000 feet high. There is no question, however, but that the intensity of the bursts was less in March than in the preceding June. The dust

➤ AN AERIAL VIEW of Parícutin, which now rises 1300 feet above its base. A whirling dust devil soars upward in the right foreground. To the left is the January-February vent, which produced the Taquí flow. Its molten rock swung around the base of the volcano and off into the background for two or three miles

OF AGE

A flight to the world's youngest and most interesting volcano produces new information and gives the expedition some narrow escapes at close grips with the fiery giant

column often drifted away like smoke from a chimney, instead of surging straight upwards for thousands of feet. However, there may be an explanation for that: the passageway for the escaping gases may have been better cleared after a year.

More of the bombs seemed to be liquid, and the granitic bombs of last summer had given way to white pumiceous bombs, as if by now the acid rock had become thoroughly melted and impregnated with gas

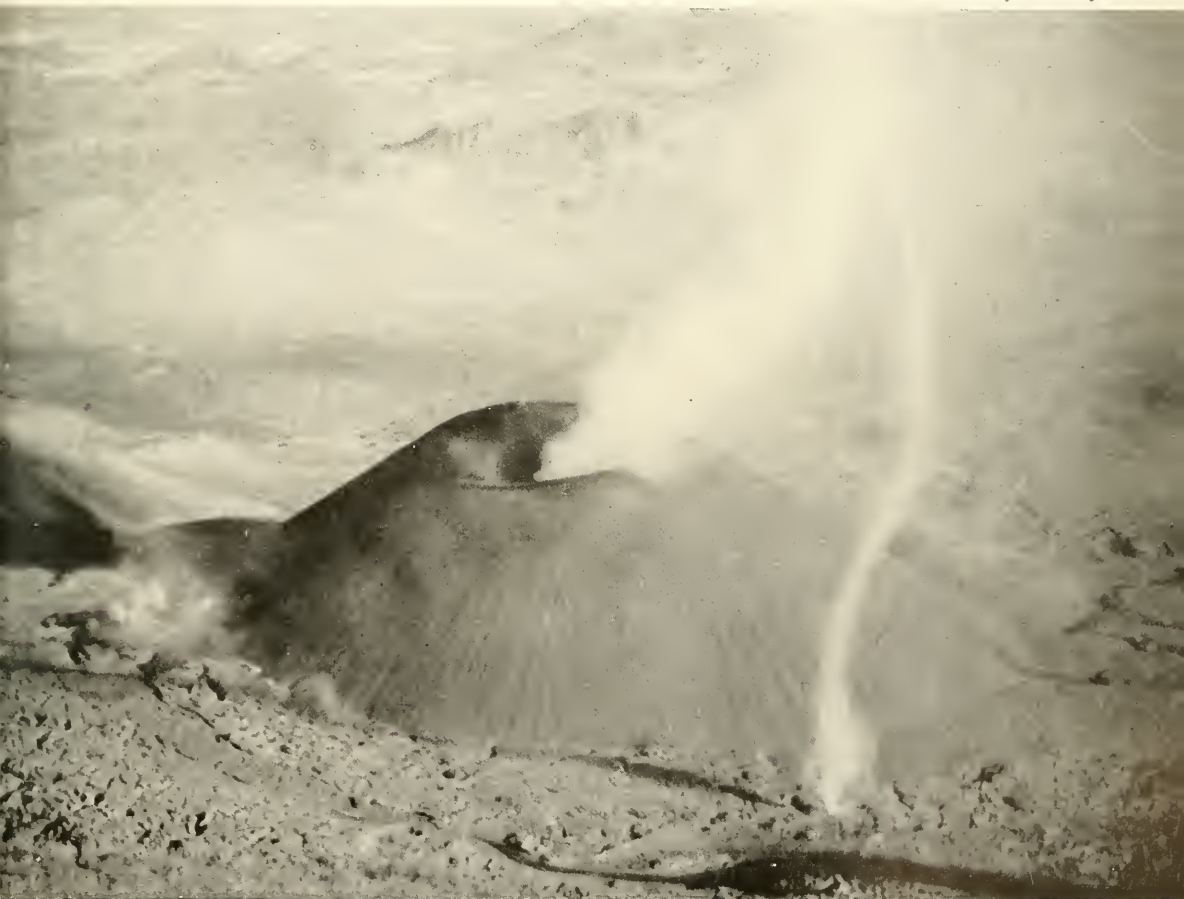
down in the magma chamber. Despite its present fluidity, however, the granite magma seems to have remained intact, as a drop of water will remain intact when stirred in a bath of oil, and to have been occasionally thrown out as a separate sort of bomb. One large basaltic mass with a white blob on one side looked from a distance like a black boulder with a whitened skull perched on it.

The steaming orifices, or fumaroles, of the old flow of last year were al-

most dead. Apparently, their lives are to be measured in terms of months. For even though a tremendous mass of still hot lava lies beneath, the gas seems to have escaped before the body really cooled. A few of the vents, which once showed sal ammoniac crystallizing at 400° or 500° F., now had tiny crystals of sulphur, an element which has come to mean to vulcanologists that volcanic activity is nearing its close and that temperatures are falling. However, new fumaroles from new flows still yielded beautifully crystallized chloride specimens, and you could still put in rocks and coat your own specimens in a few days, just as we did before.

The new flows were abundant and far more extensive than last year. We could not return to the old cabin site and take a photograph to compare with last year's pictures, for the cabin,

Photo by F. H. Pough



the old hill and the old flow were buried deep beneath a new flow, which covered them with 30 feet of solid rock. The thrifty natives had pulled up stakes and moved their cabins back before the debacle, leaving the hill and the early flow to be buried alone, along with the old boundary mark between Dionisio Polido's field and that of his neighbor. No new marker has been set up; it is clear to all that it will be many years before the hills will be green again and before another crop of corn will grow "on the other side," (Parícutin's meaning in Tarascan).

New flows are constantly issuing from the vents around Parícutin. A well marked fault fissure seems to extend across the region of the cone from southwest to northeast, and three vents have been observed so far. First we had Parícutin itself, which grew in a few months to mammoth size, larger than most of its neighboring cones. In October a new phenomenon was observed and photographed on the northeast side; lava was seen to be thrown into the air from several cracks on the surface of an old flow. In a few hours these merged into a single orifice from which tremendous quantities of material were erupted a few hundred feet into the air; and within a few days a secondary cone was built there on top of the old flow. It was christened Zapicho, "little fellow" by the natives, but for a time it seemed to threaten to rival the big fellow, so frequent were its bursts and so steady its activity. Piling up the fragments, mostly relatively small, it built a semicircular cone 210 feet high, with a broken face where flowing lava slowly emerged, carrying on its back the fragments hurled in that direction.

Dr. Clyde Fisher and his brother visited the volcano in November and saw Zapicho when it was most active, pumping out lava bombs at a rapid-fire rate, with never a quiet moment. Meanwhile Parícutin thundered away above. But gradually its activity diminished, its bursts grew weaker and its mounting dust column thinner, until it seemed that it might die entirely; its strength sapped by the parasitic little fellow robbing its vigor at the base.

Finally it stopped entirely, and a number of climbers ventured to scramble up the slipping, loose, unconsolidated pile for a peek into its mouth. Most were disappointed, for

once there, little was to be seen through the cloud of steam and gas. When it was rent for a few moments, all that could be viewed was a slope like that of the outside, reaching down to an orifice from which issued steam, dust, and ominous rumblings. One or two climbers reported seeing glowing lava at the bottom of several vents, but no photographs of this seem to have been taken.

Zapicho, though, like other parasites, apparently lacked the qualities that make for longevity, for on January 6 of 1944, it died, and soon became ancient history. Its orifice was sealed, and not even gases leaked from the once violent vent. Today one can walk with impunity on the surface of Zapicho's flow and into Zapicho's mouth, disturbed only by subterranean crackings, like those felt on lake ice on a cold winter's day. For peace of mind, one assumes them to be due to settling of the ash coating. One wouldn't like to be precipitated into what must still be near the surface, and to get to the further flows one must cross this new lava "high-way."

Shortly after the fading of the little fellow a new vent opened on the other side of the mountain. This also lay along the fissure shown earlier by fault movements and by Zapicho's growth. The gas beneath this vent could not have had the same pressure as that which activated Parícutin itself and Zapicho, for the lava appears to have bubbled up and flowed out almost as easily as a free-flowing spring of mammoth size. Day and night this flow continued, giving birth to one of the most spectacular flows yet seen. Christened Taquí, the flow extended all the way around to the other side of the cone, and then reached out in the direction of San Juan, four miles away. Only near the vent was the lava fluid and glowing. It soon froze on the surface in a great aggregate of ropy black curds, while underneath, it continued to flow off down a great tunnel, pushing forward a crumbling nose in the same sort of plastic advance noted last year. The Taquí flow has continued in activity for months, sometimes intense, sometimes quiet. Near the vents its surface soon froze and became safe for walking, but the inner heat was indicated by greater fumarole activity than noted elsewhere.

On the surface of the Taquí flow in March one could watch the de-

velopment in a few days of some of the hornitos pictured and described at Jorullo by Von Humboldt. In first rounding Parícutin in March a tremendous roaring noise, like that of a hundred engines letting off steam all at once, was heard as we neared the southwest side. Thinking it must represent some tremendous vent, we skirted the flow, holding our breath and breathing through bandanas, as clouds of hot and choking gas threatened to drive us back the way we had come. No large fumarole was discovered, but we found that we could cross the saddle between the Taquí orifice and the main cone only by making a dash up the slope above the saddle and then down the other side.

Right in the pass was a roaring vent, and all around was a noisy hell of glowing chimneys, building themselves up by the escaping gases. From time to time a glowing chunk of rock would be thrown upwards to fall a few feet away from the vent. Violently escaping gas blew the plastic lava lining of the cone upwards so that, as fluid rock crept up the sides of the pipe and blew over the top, the level was raised little by little. By piling up the lava and by blowing its own extensions, the hornitos were growing upwards. On cooling, the ejected fragments assumed a black metallic look, but the hot exposed outside of the pipes oxidized into a red earthy mass. The escaping gases must have had a reducing action, extracting oxygen from the molten rock as a Bessemer blast burns the carbon and impurities from the iron in making steel.

Later we had a chance to watch the growth of such a pipe. A crack appeared on a lava surface, and we knew from the oxidation of the bordering rock that a little hot gas was escaping. The next day the gas had eaten a hole six inches in diameter at this spot and piled a few bits of ropy metallic lava around the mouth. Another day found our baby hornito a foot high, with an aperture of eight inches, and no doubt it soon reached adult size, 5 or 6 feet tall, two feet or so in outside diameter. Dr. John P. Buwalda of the California Institute of Technology reported that when a high wind was blowing the pipes grew assymmetrically and after a while would topple over with a flash, only to start building all over again.

The highest temperatures recorded

➤ A CLOSER VIEW shows the nearly perfect symmetry of the cone and the crater, which funnels inward at almost the same angle as the outer slopes. Two vents, one giving steam and the other dust, are seen in the crater. The fluting on the cone results from sliding and settling. Later it will be exaggerated to deep gulleys by rain water

at the volcano were read with a radiation pyrometer on the linings of these pipes, and showed the lava to be fluid at 1740° F. Normally, one holds the instrument to the eye and sees a field within filled with an image of the glowing surface. This records on a photo-electric cell when a button is pressed. For measuring the heat of a furnace, such an arrangement is quite practical, but here we met with difficulty, as no one wanted his eye quite so close to the rushing torrent of gas. So the instrument was lashed to a stick and held near the vent, several readings being made to get the highest figure. Another stick pushed down the button release; and for a wonder, nothing happened to the instrument. Last year we melted the soldered terminals from a thermocouple in trying to get a temperature that was apparently too hot for the instrument.

Near-by, on the surface of the Taqui flow, we observed a flowing lava lake, possibly a broken place in the surface of the lava tunnel through which the escaping flow ran to the advancing nose. The lake was perhaps a hundred feet across, and seemed to flow quietly from a shell-like opening at one end to well past the center, where it met advancing lava from the opposite side and folded under into a crack. The effect of the two flowing surfaces meeting and going down was much like that seen when batter is mixed with an egg beater; the long groove wandered back and forth a little but remained pretty much in the same place. The surface of the lake rose and fell, sometimes arching upwards three or four feet, then lowering again for a few seconds before rising another time. At night it made a beautiful sight, glowing a brilliant orange over most of its surface as it flowed along. Probably it was feeding the advancing flow that we could see from our cabin but could not reach, being unable to climb the earlier but still hot flow on which it was coming out.

➤ A REMARKABLE VIEW of the erupting incandescent lava of the Taqui orifice. The lava bubbled out in a glowing fountain and rolled down to form a large flow. In time it reached and destroyed the town of San Juan de Parangaricutiro, four miles distant and much farther by the circuitous route the lava took



Photo by F. H. Pough

On continuing our route around the cone we soon encountered Dr. W. F. Foshag of the United States National Museum, our companion of last year, who was climbing around the other way, and we recounted our observation of the hundred gas vents. Foshag visited them and stayed till dark, coming back to tell that he had observed bluish-violet flames burning around some of the more active vents, which had become visible only after darkness had set in. Since vulcanologists love to shock their listeners by casually remarking that a volcano is giving out no smoke and no flames, here was a "how do you do." The "smoke and flames" that are popularly thought to issue from volcanic vents are in reality almost entirely ash and incandescent rock. Flames of

the sort Doctor Foshag had seen are rarely observed, but they have been reported from other eruptions, at Santorin and at Kilauea. They are attributed generally to the burning of hydrogen as it reaches the air. The hydrogen is thought to have been formed from water vapor by the removal of its oxygen as the steam comes in contact with molten rock. Such a weakly incandescent flame would never be observed against the incandescent particles and glowing steam or amid the gas and dust column of a violently erupting volcano. But above the vents it was unmistakable, whipping and flickering like any gas flame above a mammoth Bunsen burner.

Coming back later to photograph this phenomenon, we experienced our



Photo by W. F. Foshag



Photo by F. H. Pough

▲ IN JUNE, 1943, the ash had only begun to fall in the town of Parícutin, two miles from the volcano. The mighty cedars were still living. Earthquakes accompanying the eruption had caused most of the damage to the church



Photo by O. O. Fisher

▲ NINE MONTHS LATER the church lies buried almost to the top of the large door, and the trees have died. The lava has by-passed the town, but falling ash can be almost as destructive. Parícutin is a ghost town



Photo by F. H. Pough

◀ THE ROOFS have caved in, and the ash lies eight feet deep on the level. In time, Parícutin may be entirely buried

▼ STRANGE LIGHTNING. A lucky shot captured two flashes in this time exposure of the cone. At various intervals, sometimes very frequently, flashes of this peculiar type of lightning are seen in the rising dust and gases of a volcano. They can be explained as the discharge of electricity built up by the moving particles of dust rushing upwards. This lightning is quite independent of thunderstorms, which may by chance visit an active volcano

Rafael Garcia photograph, from Black Star



➤ THE PARTY lived in the cabin erected by the Geological Institute of the University of Mexico, on the crest of a ridge between two ancient craters. Doctor Foshag, Doctor Pough, and T. A. D. Nichols are enjoying the exceptionally fine view of the volcano which the cabin affords. The hut was placed at the party's disposal by the Institute's Director, Dr. Theodore Flores



Photo by Clyde Fisher

◀ MEASURING THE HEAT. The burning gas rushing from the vents of spatter cones made it safer to lash the radiation pyrometer to a stick and poke the release button with another instead of holding the instrument close to the eye in the normal way. The bandana somewhat lessened the chloride fumes, but even so, the atmosphere was far from bracing



Photograph by Te Ata

▼ THE CAMERA records the rarely observed phenomenon of true flames in a volcanic eruption. Almost always the fire that observers describe in a volcano is merely hot rocks. But here, hot gases escaping in the formation of spatter cones ignited on reaching the surface. From their color, it has been suggested that these flames are burning hydrogen, released perhaps when steam passed through hot rocks



Photo by F. H. Pough

▼ THE LAVA that erupted from the incandescent fountains contained so much gas that it spread out in a thin sheet and was cool enough to touch and break by morning.

At lower right a lava fountain goes into eruption, throwing fragments 100 feet into the air, while molten rock wells out to form a new flow



greatest thrill, got our best pictures, and had the closest escape experienced by the party. Attempts at photographs were first made with some afternoon tourists with long-focus lenses, for the flow was not too smooth and the constant danger of the choking chloride gases did not make the prospect of walking across it in the dark too appealing. Pictures were taken, but the others did not want to stay after it was truly dark, so we all beat a retreat across the difficult part of the terrain while the sunset glow still filled the sky. Afterwards, with the usual misgivings of the photographer who can't be sure about his results until it is too late to do anything, we decided to return, after good reconnaissance, and to get where a telephoto lens would not be necessary. A trip with Luis, the Indian camera bearer and assistant, was made the next afternoon. After considerable scouting around, we threaded our way between several hornitos and up a 30-foot slope littered with light brown glassy fragments of ejected material, and decided it would be safe to climb up on the ridge between the two Taqui orifices. To facilitate the climb up and down in the dark, the trip was made several times, making a trail that would be hard to miss. On the ridge we were above several of the gas vents and only about 20 feet or so from one on the far side with a necklace of black ropy lava around its glowing mouth. We were also at the base of two others that could be approached as close as seemed safe. After making this preliminary survey, Luis announced that henceforth he would charge the tourists 50 pesos a head to bring them here, but he agreed to split the profits since he had not blazed the trail. Though a truly risky looking place, it seemed safe enough when one looked down from above on the hissing vents below and all around. Unfortunately one could not get over to the cone itself because of the vent right in the saddle, which, while not as forceful as some, was still emitting noxious gases.

The way having been prepared, I returned to the scene that evening with Te Ata and Luis. We had cameras, film, radiation pyrometer, and an egg to fry on a hot bomb, and we arrived long before it would be dark enough for the fireworks to show. Killing time, we measured the temperatures of the glowing lava

forming the lining of a few more spatter cones. After waiting patiently and futilely for a hot bomb on which to cook our egg, we decided it was time to climb to our station and set the cameras up before it was really dark. Leaving the egg at the foot of the trail for future reference, we started up with Luis in the lead.

As he surmounted the crest he saw that our little necklaced spatter cone of the afternoon was becoming excited and throwing out a few fragments. So he hastened over to the edge, set up the tripod, and motioned for me to hurry along. Seeing what was up, I motioned in turn to Te Ata and hurried over to set up the camera. After exposing a few feet of film, I realized that we were really too close to get very much in the narrow field of a standard 1-inch movie lens; so I moved around on the crest a bit to get a better view, and exposed a few more feet. Lava welled up from the mouth and spilled over in a glowing orange cascade as the explosive bursts from the mouth hurled the hot fragments higher and higher above our heads. Suddenly, I heard some noises behind me from some of the cones between which we had threaded our way. Realizing the jeopardy of our position if some of them should start to erupt, I thought it might be wise to retreat while yet we could. Racing down the path, I assured Te Ata that we could dispense with the egg, and we all got out safely, with a camera and case in one hand and the movie camera still on its tripod in the other.

Once more at the bottom and on familiar ground, I found myself behind the ridge from the big show, a most unsatisfactory position. Leaving Te Ata, we attempted to work our way over the jagged lava that we had not been able to cross before, to get around to the front, but soon gave up as darkness increased and the way became difficult; we didn't care to be caught in there in an eruption. Resolving that the only thing to do was to climb on the main cone and trust Luis to look for rolling bombs while I photographed, we started up, after moving our spare film and pyrometer a little farther back.

Climbing up to get above the saddle, I noted further activity from some of the other vents and an occasional blast of rock from the gas vent in the saddle which had been so well-

behaved. It soon became apparent that we were witnessing the beginning of an eruption of very fluid lava, as more and more of the vents began to throw out fragments and as fluid lava welled up in their mouths and started to pour forth. The nearest mouth, that harmless little gas vent, soon started throwing fragments high in the air, and lava rose higher and higher, starting to sweep down the trough before us, as tremendous bubbles of glowing lava rose in the air and shattered with great "plops" into a thousand fragments. Seven vents in all were counted in our excitement, and we have since counted more in the moving picture, each erupting huge 30 or 40-foot fountains of liquid, with skyrocketing fragments of incandescent lava rising several hundred feet into the air, to fall in quickly cooling gobs almost at our feet. The lava from the many vents merged into a single rapidly advancing flow, which was coming across our path of escape. Te Ata, on the old flow, kept shouting for us to return, but her voice was lost in the clamor of the eruption, and we probably would have paid no attention had we heard. Luis said only "O chihuahua, O chihuahua" over and over again. We soon had to leave. The lava blocks were falling within a few feet of the tripod, and our borrowed pyrometer was in danger of sharing the fate of the now certainly well done egg.

Leaping down the crumbling slope, we soon outdistanced the advancing lava and paused for a few more pictures, until our stock of film finally came to an end. Here, on solid ground, we felt far more secure, well ahead of the advancing flow and beyond the flight of the towering lava skyrockets. Looking back, it seems that we were perhaps, more frightened than we need have been, but it was a terrifying spectacle. At the end of half an hour the whole display was over, and only the greatest vent in the saddle of the ridge was still erupting fragments. The glowing lava, the red-hued steam and gas, and the fiery pyrotechnics were a sight that none of us will ever forget. And no matter what other visitors to the volcano see, it is doubtful that they will ever equal that or get pictures to prove it. Next time I'd rather have a telephoto lens. And Luis said the tourist price had gone up to 1000 pesos, but he wouldn't take them even then.

➤ (At lower left) ZAPICHO: "little son" of Parícutin. Between October and December it grew to a height of 300 feet at the base of the mother cone

▼ THE DEPTH of ash from the volcano is seen here where crustal movements occurred along the fault line on which the Zapicho and Taqui vents lie. Note the beautiful stratification, resulting from changes in wind and volcanic activity

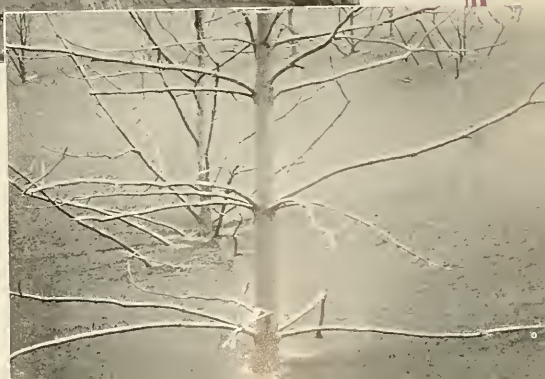
Photos by W. F. Foshag



➤ THE PINES of the once extensive turpentine forests lie buried beneath 15 feet of ash near the volcano. The bark has been stripped from the tops of all the branches by the steadily falling shower of "plutonic sandpaper." Bark remains on the under side, but the white wood on the upper surfaces looks just like driftwood bleached by the elements

Photo by F. H. Pough

PARÍCUTIN COMES OF AGE





Wet Lands and Dry Seas

The members of a scientific expedition become part of an amazing universe of sea and sky when their tiny schooner enters a domain of sea birds, sporting whales, sea-butterflies, and sparkling creatures of the deep

By
ROBERT CUSHMAN MURPHY
*Chairman, Department of Birds,
The American Museum of Natural History*

PANAMA, as every traveler knows, has its rainy season during the northern hemisphere summer. In Ecuador, only 500 miles south of the Isthmus, the pattern is reversed and the wet period falls during our winter months. In between lies the Colombian Chocó, where the rains of the north and the south may be said to overlap, so that land and coastal ocean receive the deluges of both—summer, winter and all the year.

We approached the Chocó before Comandante Fallon joined "Askoy," and I wasted breath trying to convince five companions spoiled by fair weather of what we were in for at the transition. It came with dramatic suddenness when we neared the latitude of Cape Chirambirá, a month out of Balboa. Late one evening all of us were on deck in soft moonlight,

trying with dip-nets to catch a sea bird that was fluttering about the schooner. Before the dawn that followed, rain was pouring out of an impenetrable sky, dripping through long-parched seams, finding its way copiously into our berths, to the chart table, the lockers, and nearly everywhere else. It was no shower like the dry-season bursts we had known at Colón. Beginning without prelude at three o'clock in the morning, this first taste—or swallow—of the Chocó continued with no rhythms in the downpour for four hours. Then, instead of dying away, it simply stopped, and the ocean that had been peppered with uniform spurts lay flat and gray and greasy-looking.

Fallon, of course, was part of the tradition of rain. By sounding and other means he could pilot our craft

to a snug Chocó anchorage when ocean and atmosphere were but one world of water, when, until we were at the verge of piling aground, we could see no more of *terra firma* than Noah from his Ark. On such occasions the cheerful *comandante* would beguile us with wet tales that were commonplaces of the region. Here is a sample:

"A Colombian troop transport from the Caribbean coast arrived, according to its dead reckoning, off Buenaventura on just such a day as this. Unable to make a landfall, the prudent captain anchored and announced that he would lie outside until the rain slackened. He waited eleven days and then took his vessel in—in the rain."

But "Askoy's" track regularly carried us out at right angles from the

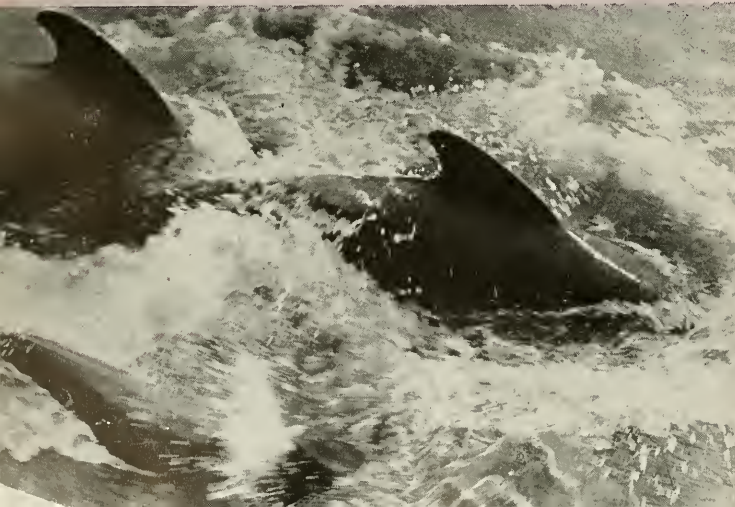


▲ BUENAVENTURA was the first port of entry after the expedition left Balboa in the Canal Zone. Here, at sunset, the little schooner "Askoy" (center background) swings upstream at anchor in the strong flood tide of the estuary, with river steamers, power-bongos, and other craft as neighbors



▲ FROLICHSOME PORPOISES, far off-shore from the Chocó coast

▼ POT-HEADS OR BLACKFISH. This cetacean, which might be called either a large porpoise or a small whale, normally reaches a length of from 12 to 15 feet. The rich blubber of its blunt head or "junk" yields watch oil, the most valuable of all lubricants



panied by a calf, which clung closely and rolled out only in unison with its mother. A stranger parade never was seen: the Roman head and bare, muscular torso of our engineer, sticking up like Neptune whenever his boat was hidden by the billows, his blubbery retinue following in the light of silver dawn.

We were about to begin working a station, but the presence of six or more kinds of ocean birds near the schooner led me to duck my responsibilities of the moment at wires and winches and to set off alone in the skiff. Presently a white booby made as if to alight on the stern thwart but then changed its purpose and kept passing over me with a soft whining of the wing quills while it inspected the unfamiliar flotsam and its occupant.

A light breeze arose, and I laid on the water a slick of herring oil, of which a few drops will cover many square rods. Very promptly storm petrels or Mother Carey's chickens began to appear, always approaching upwind, not from random directions as they would have if sight, rather than their sense of smell, had guided them. Birds of other kinds, on the contrary, were evidently attracted by observing the petrels instead of either seeing or smelling the oil film. But Mother Carey's chickens were the only sea fowl that could profit, unless larger particles of bait were tossed into the oily patch. Two kinds, namely, black storm petrels from California and white-rumped storm petrels from Peru, fluttered and danced by scores around the skiff, gobbling up the infinitesimal globules of fish oil.

Several bits of river wreckage were about, even this far from land, and from one of them I fished up three coastal crabs. Beneath a long and thick bamboo were two large dolphins and two clouds of tiny fishes, each of a different species. The predacious dolphins were obviously no menace to these particular lesser neighbors, which swam boldly about their snouts. Perhaps the dolphins require the glint of fleeing prey to spur them into the dash with which they run down the flying fish. In any event, when I touched the log with an oar, the dolphins were unimpressed, but all the little fishes of one kind promptly abandoned their sheltering or orienting bamboo and attached themselves to my boat. They re-



maintained for an hour, until I had returned to "Askoy," whereupon they darted under the schooner's counter and huddled together in the azure shade.

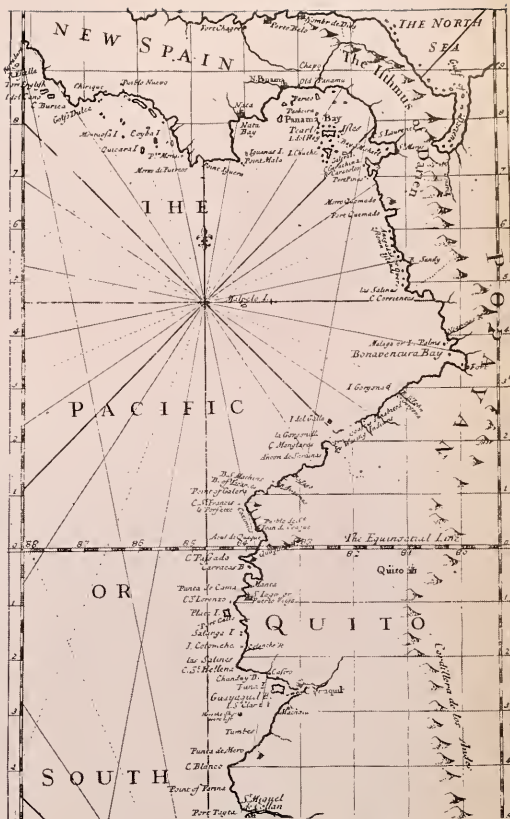
In these facts may there not be the germ of an idea that partakes of universality? Even the little surface fishes of the lonely ocean seek something to which they can cling and which they can make the center of their cosmos. Perhaps the log serves as a "Mutterkumpan," to use a term of the German behaviorists, or perhaps it become the great totem of the clan. But the fickle or aspiring school forsakes the bamboo for a boat, and then the boat for a ship. And, when "Askoy" sets her canvas to a brisk wind and cuts out for a new goal miles away, the too trusting little fishes are cast adrift and must search for still another idol!

The presence and, more particularly, the unaccountable behavior of "Askoy" were obviously a puzzle to the few vessels we met offshore during a period affected by war jitters. Late at night while we were working Station 84, nearly 50 miles off the Ecuadorian coast and five or six south of the equator, a small steamer approached within a mile of us, slowed up, and then stopped. We waited to hear from her blinker, while keeping on with our task, but all the sinister possibilities of misinterpretation did not occur to us until later.

In the first place, we were circling while towing our plankton nets, forgetting that circling at sea is one of the international signals of distress. Then again, our great boom sticking out over the port side must have looked like a five-inch gun in the glare of an overhead globe that illuminated only a bit of the deck, leaving the shape and rig of our craft completely hidden in darkness. Moreover, the rapid coming and going of five or six men within the sphere of the light formed a sort of stage army, and doubtless made it appear to watchers on the steamer that a large crew was inexplicably active, perhaps on the deck of a submarine. After eight or ten minutes, with no message flashed, our neighbor doused its mast-head and cabin lights (which would have had the effect of depriving us of the range), swung about, and made off on a new course as fast as it could go. It is quite probable that the news-

▲ A COLOMBIAN BOOBY flies up to inspect the strange beings on "Askoy." This bird is a Chocó race of the widely distributed brown booby

➤ "ROBINSON CRUSOE'S MAP" of the Chocó coast. Alexander Selkirk, the original of Defoe's hero, after being rescued from his exile on the island of Juan Fernandez, became master of one of Captain Woodes Rogers' vessels and prepared this excellent chart from manuscript drafts taken in Spanish prizes. It was published by Captain Rogers in 1712



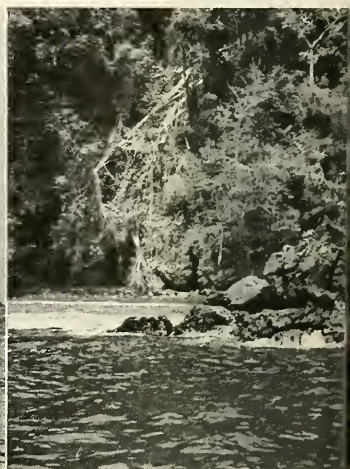
▼ "ASKOY" on station, as seen through a swirling gap of the Octavia Rocks, off Point Marzo, Colombia. Although these islets lie off a densely forested coast, their only vegetation is a cactus (*Holocereus*), growths of which show on the wall at the right





◀ SINCE the days of the Spanish conquistadores, the Chocó coast has been a trade route of strange craft. This one is the Ecuadorian cargo sloop "Olmedo"

➤ THE LEADER OF THE EXPEDITION: Dr. Murphy, announces that Malpelo appears over the horizon, dead ahead



▲ THE SYMBOLS of dry seas and wet lands. On the left, only 267 miles west of the continental coast of Colombia, rise the practically plantless steeps of Malpelo Island. The appropriate name

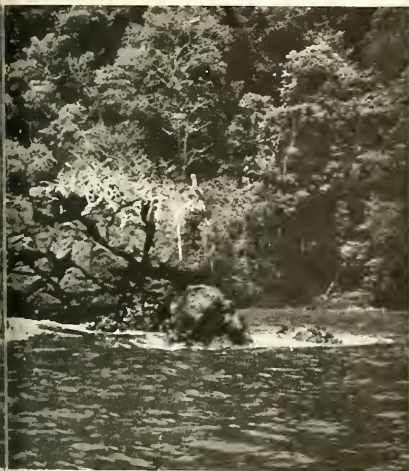
means "a bad head of hair." Throughout the year Malpelo receives insufficient rain to support more than a faint trace of vegetation.

On the right is the vast luxuriant tropical

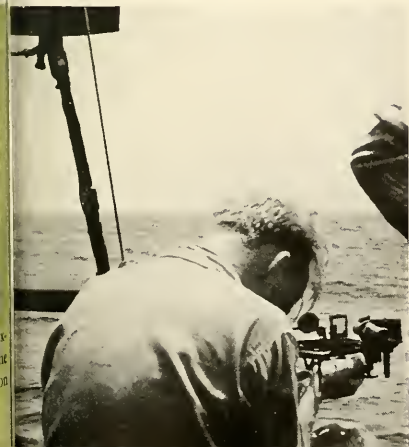


◀ MATE FRANÇOIS AND ENGINEER PAAR set the head sails of "Askoy" so that she may resume course after the completion of work at an oceanic station

➤ READING the sextant to determine the ship's position



rain forest of the Colombian coast, primeval in all respects, with clearings only where giant trees have been cast down by lightning. This scene is at Aguacate Bay



paper of some little South American port subsequently published a tale that we should very much like to read.

Another time, in the grayness of a cloudy morning, just coming day-break, a large steamer abruptly altered her course to pass near "Askoy." At first we took her for a man-o'-war, but she turned out to be a modern, rangy freighter, with a rounded forefoot. After slowly crossing our bow, she blinked at us from the bridge, and we answered with a hand flashlight, "We are ready to receive your message." The stranger then began to inquire as to our name and flag, but suddenly concluding that we were neither sinking nor starving, her captain lost interest and turned off toward Australia.

Of course we told Robert, the mate, that she was a German raider that had inquired whether we had any Belgians on board. Robert replied, in measured English: "We work hard on 'Askoy' but we laugh much; it is pleasant." Robert, God-bless him—he is now pilot of an R.A.F. Spitfire, alive and well at this date of writing—had reason to be wary of the pranks and prevarications of his shipmates. He bore the onerous responsibilities of cook, in addition to full duties of seamanship, and he called our polylingual group to meals with a cheery "*Schaften!*", the Flemish implication being that the trough was full. One morning Comandante Fallon had him half persuaded that if he would only stir popcorn kernels into the batter, the flapjacks would somersault under their own power at the exact moment that their bottom sides were browned.

De Profundis

At the hour when spring was beginning up home, we were off from the Colombian coast just north of Buenaventura on our transect toward Malpelo. This meant also that within less than three hundred miles, along the same parallel of latitude, we would run far beyond the rains and pass from reeking and luxuriant tropical forest to the bare rock walls of an island that receives next to no precipitation during most of the year.

For about a hundred miles offshore gray coastal water, thinly speckled with leaves, twigs, and other flotsam dominated the ocean surface. Gradually the hue altered to glaucous green, and then, abruptly, to the clear ethereal blue that is the symbol of

the warm "high seas." The bathythermograph, no less than the expectant eye, revealed the change, and simultaneously the showers gave out and the nights turned glorious, often without a trace of cloud in the vault.

Blue water meant a new and strictly pelagic population both at the surface and in the transparent fathoms below us. *Halobates*, the sea bug or water-strider, which enjoys the distinction of being the only oceanic insect, made miraculously quick darts alongside "Askoy" in calm weather. One under close observation would simply appear in a new spot, without ever being seen on the way. Pteropods of the group known as sea butterflies fluttered beneath the surface and, more gently through the crystal shadows, moved frail, exquisite ribbon-ctenophores which for thirty centuries seafarers have called Venus' girdle. In earliest evening we would sometimes discern in the quiet deep a gleam like a diamond and involuntarily lift our eyes to seek the first-magnitude star responsible for so brilliant a reflection. But no such star had yet appeared in the heavens, and each star in the sea, appropriately called *Sapphirina*, continued to blaze like a nova and go out.

The acme of luminescence was revealed to us one evening, when a plankton-sampler was hoisted up with a strange captive squeezed between metal messenger and frame. The creature, shaped like a cucumber, was nearly a foot long and looked like tough, colorless jelly until we grasped it. Then it burst aglow with an intense light. Armstrong used a fingertip to write "Askoy" on its back, and within a moment the name of our vessel came out in fire. *Pyrosoma*, the "fire body" it was, a swimming ascidian which, until that night, I had known only as a legend of the "Challenger" Expedition.

For a double watch on the evening of March 22 I had the wheel, holding a course true west in a cool, fresh breeze. A bearing more exhilarating than that pointed by the compass, however, I found in the sky, just halfway between Canopus to the south and Capella to the north. Sirius, over the port shrouds, then balanced Castor and Pollux on the starboard. Paralleling the latter pair, the triple stars of Orion's belt peeped over the spreader, and Regulus hung for a time nearly above the mainmast head. Red Aldebaran, to the right, seemed linked up with blazing Jupiter until

both rolled down beyond, dragging the faint Pleiades after them.

In this stage of the voyage the wires of lowered oceanographic instruments, as well as our navigational reckoning, began to show that we were encountering a strong, warm and shallow current, proceeding from a northwesterly quarter. One effect of a conflict in force or direction between superimposed layers of ocean water was that our wires vibrated strongly as soon as they had been sent below the depth of surface movement. We could see as well as hear the humming in short sections of the tense and weighted cables, each such blurred spindle being separated by nodes of motionlessness from adjacent sections. The violent movement caused the wires to cut like a file, so that polished grooves appeared on the plates of "Askoy's" hull. We particularly had to watch the snaphooks of our lowering gear so as to replace them before they were sawn through.

In the same period, curious phenomena in the dark blue water indicated the effect of surface movement on the underlying stable and stratified layers of ocean. On Sunday morning, March 23, for example, "Askoy" passed in calm weather close to several areas of "dancing water," of an extent varying from one to a few acres. The disturbed patches were sharply marked off from the ocean round about, and within each of them small, extraordinarily steep waves appeared to be running at random, breaking into thin white crests before they subsided. The general aspect was that of a lively tide rip over a bar, yet we knew that more than a mile of abyss lay beneath us. It was apparent that friction and upwelling were in progress—that deeper water was rising in some sort of vortical overturn—but it was reserved for the evening of this memorable Sunday for us to witness yet more striking, and even awesome, aspects of what was taking place in the sea.

About eleven o'clock Robert, at the wheel, called me on deck. The night was still, cloudless, and black despite the stars, and "Askoy" had no headway. The ocean, nevertheless, was dancing all around the schooner, little points of waves leaping into the air and exploding into the smallest of whitecaps. The display was pyrotechnic as well as audible because the water was pricked with sparkling organisms, especially with the copepod

that made tiny sunbursts of blue light.

Comandante Fallon awoke with a start in his blanket atop the after cabin. In his sleep he had heard breakers off the starboard beam, and now my ears also picked up the ominous sound. Sober consideration told us that we were two days' sail from shoals of any sort, but the illusion was persistent and slightly terrifying.

On either side, and at a bafflingly uncertain distance from the ship, a dark line, like a wall of advancing water, seemed to be closing in upon us. By this time the schooner herself lay in a pool of almost complete calm, but we could hear the splash and murmur of a troubled surface close by, which was all the more impressive because there was no breath of wind to keep our limp sails from slatting. Presently we could see a gleam of foam sprinkled with points of luminescence on the slowly approaching swell or head to the left. Vague and unfounded thoughts of marine earthquake bores occurred to Fallon and me together, and we felt peculiarly helpless with a dismantled engine and no breeze to make the craft answer her helm. The dreamlike slowness of all that was going on, moreover, gave me a feeling that I had not yet fully shaken off the bonds of three hours' slumber.

However, when the dark, white-outlined menace reached us, it proved to be nothing more than a field of the dancing water, tossing its little peaks a mere foot or so into the air and beating a tattoo on the steel flanks of "Askoy." The front moved past us, and we lay for some time in a turbulent area which contrasted strongly with the preceding glassy calm, and which imparted to our hull enough of a tremor to rouse the remaining sleepers.

Presently a sharp hissing sound, different in character from the bursting of small waves, came out of the blackness to starboard, and this was followed by strange sighings and puffings. Armstrong leaned over the side, peering, and Oscar's grease-stained face issued from the hatchway of the engine room where he had been slaving half the night, installing a new condenser. After listening a moment, spellbound, he fetched the electric searchlight on deck.

The puffers were blackfish, many score or perhaps hundreds of them, rolling and lumbering along and diving to pass beneath "Askoy" shortly before they reached her bilge. Others

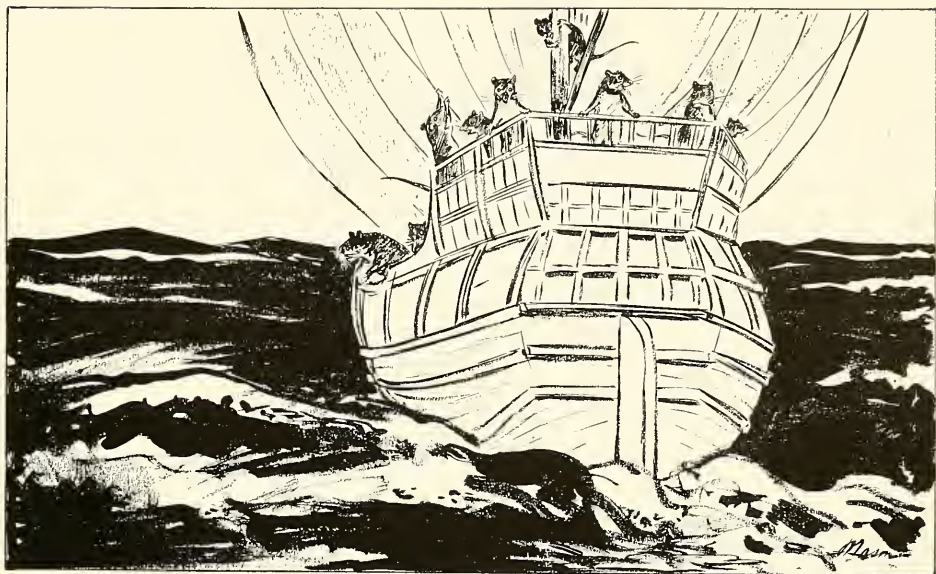
were evidently crossing bow and stern, because we could hear the bacchanalian clamor of their rumblings and belchings. In the long beam of the searchlight, the hissing proved to come from the jumping of small fishes. In all directions as far as the light carried, they were shooting into the air and pouring down like hail.

We turned the brilliant ray close beside the port quarter while we fished with dip-net and plankton net for more than an hour. The surface was seething, boiling, with life, much of which was *de profundis*. Larvae of clawless lobsters, tinted jellyfish, nurse chains of salps, small herring-like fishes, a silvery hatchetfish with its face bitten off, rudder-fishes hanging head downward, luminous lantern-fishes with shining light-pores, red and purple swimming crabs, other creatures which we could not name at sight, and much that was too small even to see distinctly—all swarming about under the searchlight, while pink squids, from a few inches to a foot or more in length, kept darting from below, causing the showers of fry from water to air and back again.

A general holocaust was in progress. The little fishes were eating invertebrates or straining out the plankton; the squids were pursuing and capturing fishes of various sizes; and the blackfish were no doubt enjoying the squids. How they take possession of such extraordinarily swift and agile creatures is still a mystery, but squid remains are all I have ever found in a dozen of their stomachs.

As the night wore on, the amazing manifestations of abundance and devouring gradually, almost imperceptibly, died away. Eventually, "Askoy" lay once more in water that seemed as still and dead as oil, and the lap-lap of skipping waves drew off farther and farther into the distance until it was lost. In a bucket of salt water on deck, three delicate lantern-fishes or Myctophids, with great mother-of-pearl eyes, fragile coats of huge scales, and glowing port-holes along their sides, were also dying, the process told by a steady fading of what had first looked like fish-shaped bulbs of incandescent gas. The small hours were come, and berths once more beckoned all save the two men on watch. But Armstrong and Fallon, who never allowed drowsiness or fatigue to rob them of opportunity for further enlightenment, set about the quarter-hour task of an extra lowering of the bathythermograph.

VOYAGE OF DISCOVERY



By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON

ON the twelfth of October this year we celebrate the 452nd anniversary of the landing of Columbus. Although the Norsemen, and perhaps others, had landed in the New World before him, it was his voyage that led to the settlement and development of this hemisphere by Europeans.

Long before Columbus sailed his small ships across the broad Atlantic, land animals occasionally made voyages quite as hazardous as his, although their trips began against their will and depended on chance for success. To many animals water is a barrier hard to pass—even a large river may form a boundary beyond which certain species do not go. The Macassar Strait, between Borneo and Celebes, was once only about 25 miles wide, but many of the mammals found in Borneo have never been able to cross this water barrier. East of the Strait we do not find bears, dogs, cats, members of the weasel family, most hoofed mammals, true apes, and others, although some of these swim well. On the other hand squirrels, rats, and a few other types did get across in spite of the fact that they swim poorly and would be quite attractive to any large fish that they

might meet. Various kinds of rats have, in the course of thousands of years, crossed wide stretches of ocean, traveling on natural rafts.

Such rafts are frequently seen in the tropics. Large rivers in the rainy season often undercut their banks. Great trees and tangled masses of vegetation fall into the river and are carried along, sometimes jamming into other trees and forming floating islands. Small mammals and other land animals that have been living in the trees are sometimes carried out to sea with them, or animals that were swept away by the flood may climb on board. Natural rafts so large they were actually taken for islands have been reported, floating miles from shore.

A voyage that may have been the longest ever achieved by a mammal was made by some small South or Central American rats. They were

carried as far as the Galápagos Islands, more than 500 miles from the nearest point on the mainland. These islands were never connected with the continent; they were pushed up from the depths of the Pacific by volcanic action. Since the currents do not run from the mainland to the islands directly but circle around from Central America or from Peru, the rats must have journeyed much farther than the shortest distance, perhaps 700 or 800 miles.

Think of the difficulties of such a voyage! The currents of the ocean are broad; only by good luck would such flotsam be carried to the shore of these pin-point islands. Only small mammals could make the trip, for the food supply had to last a very long time. Finally, several animals of both sexes had to reach the island together, or a female carrying in her body the beginnings of a new colony. Otherwise the voyage would have been without lasting result.

During ages past many hundred of rafts carrying rat passengers have been carried down great rivers to the Pacific and caught in the mighty ocean currents, but only once or a very few times did these unwilling adventurers make land on the islands to found a colony. The rats on the Galápagos are different from the species on the mainland, although they show many traces of their origin.

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SEEIN throu CAME

"Two of

By LYNWO

◀ BLACK SWALLOWTAIL CATERpillars

*resting on carrot leaves
between meals*

▼ ROUND TWO IN A BEAR-CUB BOUT



SEEING NATURE THROUGH THE CAMERA'S EYE

"a Kind"

OD M. CHASE

Frederic Lewis Photographic Agency



▲ GRAY SQUIRRELS
at the free-lunch counter

◀ A PAIR OF FAWNS,
resting in the shelter of a
tree trunk

▼ TOADS and
"TOADSTOOLS"



SEEING NATURE THROUGH THE CAMERA'S EYE

AUSTRALIA

By WILLIAM K. GREGORY

*Curator Emeritus of Comparative Anatomy
The American Museum of Natural History*

CONTINENTS, like men and empires, have their histories, and the story of Australia could fill many libraries. We shall attempt here only to show some typical facts, scenes, and events as part of a general pattern that has developed through the ages.

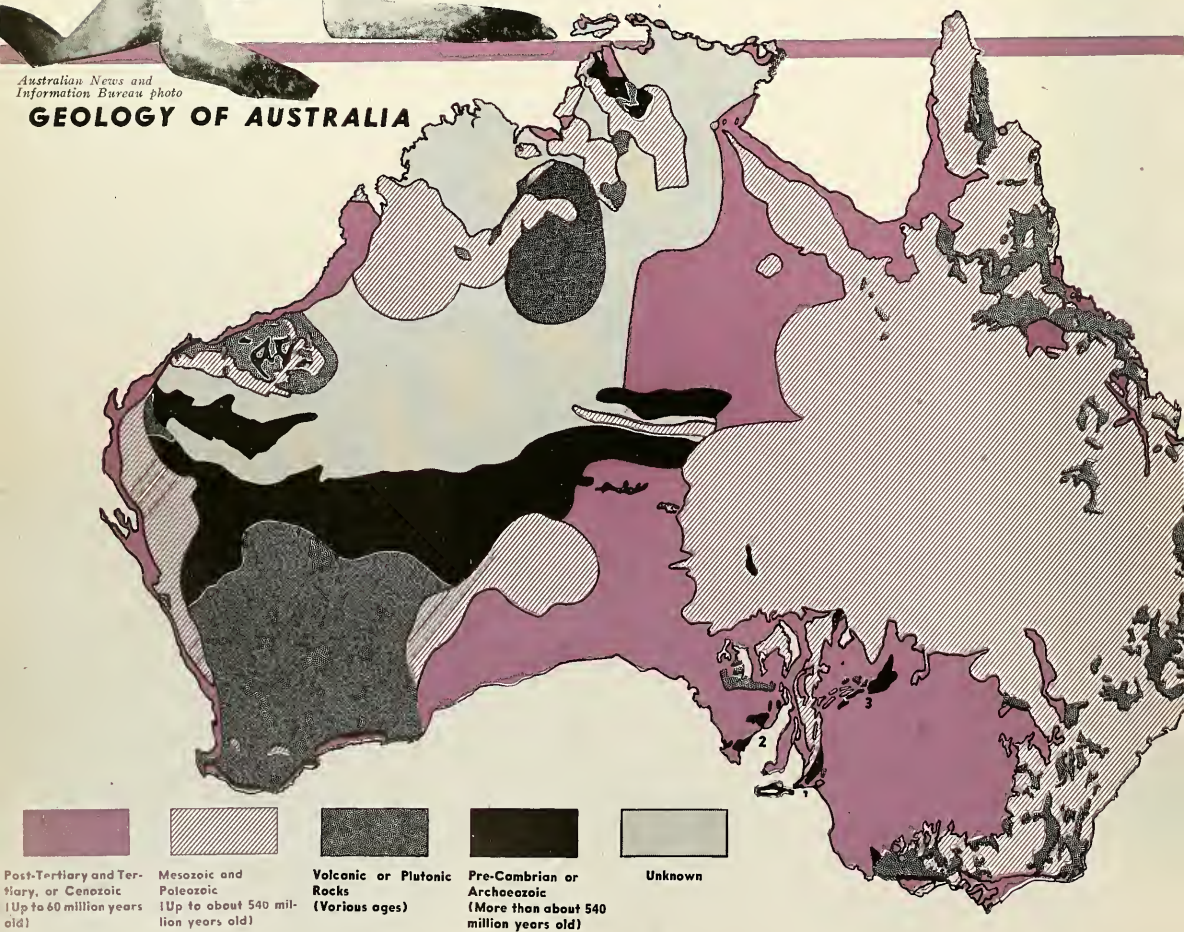
Australia, including Tasmania, has an area of nearly three million square miles; this is almost as large as the United States of America. It is a vast, nearly flat land, surmounted in some regions by low mountains.

The geologic map of Australia is a patchwork of many colors, as can be seen in the accompanying simplified

◀ KANGAROOS are the best known of Australia's marsupials, or pouched mammals. The young kangaroo is fed with milk from nipples located inside the pouch

*Australian News and
Information Bureau photo*

GEOLOGY OF AUSTRALIA



the story of a continent

How the island continent, in spite of its isolation, became the home of its strange plants and animals and was at last claimed by man



drawing. It has often been said that Australia is the most ancient continent in the world, but Sir Edgeworth David, summarizing his own and many other geologists' findings and classifying the older, or Pre-Cambrian, rock systems of Australia, tentatively equates them with the equally ancient Archaeozoic and Proterozoic series of North America. Indeed, the entire geologic column, or sequence of rocks, in Australia corresponds in a general way with that of the rest of the world.

In ages past the land of Australia

has been repeatedly folded into mountains and fractured into huge blocks. Some of the latter have settled, others have been squeezed upward. But the steadily working forces of gravitation and erosion (including heat and cold, wind and blowing sand, rain and flowing water) have worn the different blocks down to such an extent that, with the exception of the low mountains and a few gorges, the country forms a vast nearly flat surface, or peneplain. The patchwork noted above on the geologic map of Australia therefore indicates what is left, on the sur-

THE SIZE OF AUSTRALIA is almost exactly the same as that of continental United States

face, of the rocks of successive ages.

In the earlier (Palaeozoic) ages, the climatic and physical conditions prevailing in North America and Europe extended for the most part also to the southern continents. Therefore many of the lower marine creatures that were characteristic of the different ages attained an almost world-wide distribution and are now represented

Australian News and Information Bureau photo

◀ THE GEOLOGIC PATCHWORK of Australia. The oldest rocks form the deep foundations of the continent and cover the greater part of West Australia, extending downward to unknown depths. Here are thousands of square miles of granites and other igneous rocks which have welled up from below in a molten condition, melting their way into the clays and sandstones laid down in still earlier ages, mashing, squeezing, and shearing them into schists, gneisses, and similar altered rocks. Relatively narrow strips and patches of the older rocks may be seen in the Mount Lofty (1) and Flinders Ranges (2) of South Australia, in the Broken Hill field (3) of western New South Wales, and in a few localities elsewhere. (Drawing adapted from map by Leo A. Cotton.)

➤ THE APPEALING KOALA, an animal about two feet long, also has a pouch. Like some of the other Australian marsupials it lives in the branches of eucalypts and feeds on their leaves





Modified from Univ. of Sydney map

Australian News and Information Bureau photo

by fossilized remains in Australia as well as in other continents.

In the later or Cenozoic ages, on the contrary, Australia developed some highly peculiar land animals, especially the marsupials, or pouched animals, many of which still survive. These are among the forms often called "living fossils," which have contributed to the erroneous popular belief that Australia itself is older than other lands.

The great interior desert of Australia acts like a gigantic mirror and sets up the heat rays of the sun and sets up a huge ascending column of dry air. This would tend to draw the moisture toward the interior from less dry marginal zones, but the mountains of the Victorian and eastern highlands catch more than their share of the moisture of the clouds that drift over them from the sea. Therefore there is relatively abundant rainfall on their eastern slopes (over 40 inches a year), whereas the interior remains dry. Along the coastal belt there is a luxuriant vegetation, including the rain

forests of Queensland and the tree fern gullies of Victoria.

From the western or northwestern slopes of these mountains the water drains toward the Central Basin. Thus the great Murray-Darling river system runs mostly southwest toward the Southern Ocean.

Long droughts, even in the relatively well watered regions of the Central Basin, may cause the rivers to dry up, while at other times prolonged rains are followed by the flooding of wide areas. This alternation of drought and flood, acting through many ages, has bred many remarkably tough and resistant native forms of plant and animal life.

Australia has been called the land of the eucalypts, for these are the dominant trees over thousands of miles, except in the desert. They in-

◀ THE GREAT INTERIOR DESERT acts like a gigantic mirror and causes a huge column of dry air to rise. This draws moisture-laden air in from the coasts. But the damp winds drop most of their moisture on the mountains



➤ DENIZENS OF THE ARID INTERIOR: mountain devils, otherwise called horned dragons (*Moloch horridus*). These lizards grow to a length of about eight inches and are quite harmless

Rainfall



THE RAINFALL is heaviest on the eastern slopes where the highest mountains are. In January the rainy belt extends across the northern coastal region; in July, the southeastern and southwestern coasts get the most precipitation

Physical Division



ELEVATION largely determines the pattern of life in Australia through its influence on climate, drainage, and vegetation. The eastern coast and highlands, particularly in the south, have the densest population

Vegetation

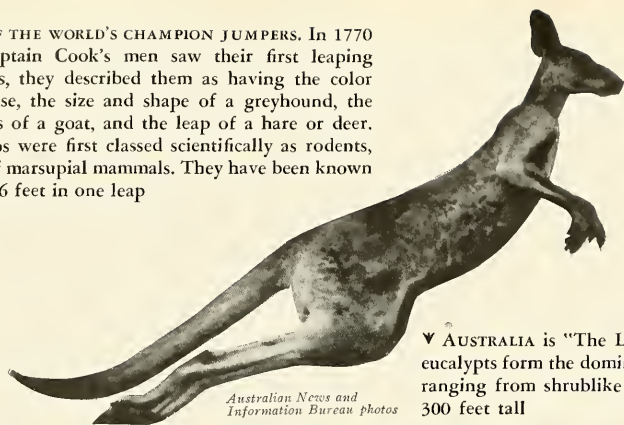


FROM THE RAIN FORESTS of the coast to the deserts of the interior, the vegetation of Australia varies greatly depending on climate. The ten main zones of vegetation are shown at lower right

Maps adapted from Australian official Handbook



► ONE OF THE WORLD'S CHAMPION JUMPERS. In 1770 when Captain Cook's men saw their first leaping kangaroos, they described them as having the color of a mouse, the size and shape of a greyhound, the footprints of a goat, and the leap of a hare or deer. Kangaroos were first classed scientifically as rodents, instead of marsupial mammals. They have been known to clear 26 feet in one leap



*Australian News and
Information Bureau photos*

ments, from the rain forests of the coast to the deserts of the interior. The mulga is a highly modified acacia, which flourishes over thousands of square miles in the drier areas. The mulga grass which grows among the mulga trees forms valuable forage. The handsome bottle brush flower, which is the national flower of Australia, also belongs to the Acacia family.

Pines and other coniferous trees

▼ AUSTRALIA is "The Land of the Eucalypts." The many varieties of eucalypts form the dominant vegetation over thousands of square miles, ranging from shrublike forms 10 feet in height to forest giants over 300 feet tall

clude the "gums," box, ironbark, stringybark, and many others. As there are said to be nearly 400 species of eucalypts, it is a common saying that there is a eucalypt for every day in the year. The mallees are shrublike, dwarf eucalypts about ten feet high, with several trunks. They cover some of the inland plains, especially over a broad zone that extends along the coast of the Great Australian Bight, or Southern Ocean, to the west coast.

This great diversity of the eucalypts suggests that they have had millions of years to vary in all directions under the peculiar conditions of climate and soil in the continent as a whole and in its varied regions. For example, in most species of eucalypt the leaves hang with their broad surfaces vertical, thus offering as little evaporating surface as possible to the sun's rays in a land of excessive sunshine and dryness; but in a few primitive species the leaves retain the horizontal position, as in trees that have not had to take special precautions to conserve moisture.

The eucalypts have a few relatives in the Netherlands East Indies, New Zealand, and South America, but all belong to the Myrtle family and are related to the myrtles of the Mediterranean region.

It is uncertain by what route the ancestral eucalypts spread to Australia, whether southeastward from the Netherlands East Indies, or northward by way of a former land bridge connecting Australia with the once fertile continent of Antarctica.

The Australian wattles, or acacias, rival the eucalypts in diversity and are also adapted to many environ-





◀ DISTRIBUTION OF POUCHED ANIMALS

1. From North America, opossums of the Cretaceous period spread through South America to produce all the South American marsupials. 2. In northern Asia during upper Cretaceous times other opossums are presumed to have migrated to Australia to give rise to the existing Australian marsupial fauna

Note that the ocean is less than 600 feet deep over a relatively large area between Asia and Australia. This means that if the sea were 600 feet lower than at present, most of the islands between the two continents would be united

Adapted from W. D. Matthew

of fold of skin on the under side of the abdomen, and that the young were fed with milk from the mother's nipples, which were inside the pouch. Gradually it was realized by European naturalists that many species of Australian animals which were quite diverse in external form and habits had this peculiar method of caring for the young, so that the group was named Marsupialia, or pouched mammals.

Eventually it was understood that the many different kinds of marsupials merely paralleled or resembled certain animals of the northern world without being closely related to them. For example, the Australian rabbit bandicoots have long ears and long legs like our jack rabbits, but they are not rabbits at all but marsupials.

Another Australian animal, the wombat, is often called a badger, because it is a stout powerful beast with short legs and strong claws with which it digs a hole in the ground. But again it is a marsupial. The "tiger" of Tasmania is so called because it is a fierce, flesh-eating animal with cross stripes on its back and sides; but it is really far more nearly related to the kangaroo than it is to the tiger. So too the Australian "flying squirrels" are not squirrels but marsupials, which somewhat resemble the flying squirrel of North America in appearance and habits. Even the Australian opossum is not a true opossum. The name is said to have first been given to it by Americans, who thought it looked like the Virginia opossum.

Nevertheless, the American opossum is a true marsupial, with a deep hereditary kinship with his Australian

flourish in the great rain forests of Queensland and Tasmania, some of them attaining gigantic size.

Among the hardwoods, southern beeches (*Nothofagus*) abound, especially in parts of Tasmania. They are called evergreen, antarctic, or mountain beech and are related to trees of the same genus in South America.

The marsupials, or pouched mammals, must have existed in Australia for millions of years, for they have branched out into many peculiar forms. In 1770, when Captain Cook was at Botany Bay, near the site of the present city of Sydney, he and his friend Mr. Banks, the naturalist of the expedition, saw a strange animal, which they afterward described as follows:

Botany Bay, May 1, 1770

We had a transient and imperfect view of a quadruped about as big as a rabbit [it was a rat kangaroo]. Mr. Bank's greyhound, which was with us, got sight of it and would probably have caught it, but the moment he set off he lamed himself against a stump which lay concealed in the long grass.

June 24, 1770

I saw myself one of the animals which had been so often described; it was of a light mouse colour, and in size and shape very much resembling a greyhound; it had a long tail also, which it carried like a greyhound; and I should have taken it for a wild dog, if instead of running, it had not leapt like a hare or deer; its legs were said to be very slender, and the print of its foot like that of a goat; but where I saw it the grass was so high that the legs were concealed, and the ground was too hard to receive the track.

July 8, 1770

... they saw four animals of the same kind, two of which Mr. Bank's greyhound fairly chased, but they threw him out at a great distance, by leaping over the long grass, which prevented his running; this animal was observed not to run upon four legs, but to bound or hop forward upon two, like the *Jerbua*, or *Jaculus*.

Because the kangaroo leaped about on its hind legs like a jerboa, one of the first scientific names given to it was *Jaculus giganteus* (gigantic jerboa) and it was thought to be a member of the rodent tribe. But it was soon discovered that female kangaroos differed widely from all rodents in carrying their young about in a pouch

cousins. All students of the subject agree that the American opossums, whose known fossil ancestors extend back in North America to the Age of the Dinosaurs, are extremely generalized, primitive forms of marsupials. They have not developed any of the strange specializations, either of the teeth or of the feet, that are found in the kangaroos, wombats, and other marsupials of Australia. In the anatomy of their reproductive organs, brain, and other deep-seated parts, these diverse Australian forms show an essential unity of ground plan which further supports the view that they have all been derived from a remote common stock and that this stock still survives in a slightly modified form in the American opossum.

But at what period of time and by what route did the ancestral marsupials arrive in Australia? According to the interpretation of the evidence by W. D. Matthew, the fossil marsupials of South America and the existing Australian marsupials have been derived independently of each other from an ancient common ancestral opossum stock which lived in North America and Europe during the Cretaceous Period (the Age of Dinosaurs). The weak point of this theory is that no remains of ancient marsupials have been found in southeastern Asia. The opposing view is that the living marsupials of Australia are closely related to the fossil marsupials of South America and that these two continents were connected at one time by land bridges with the Antarctic continent, which at an earlier period must have had a mild climate, to judge from the evidence of fossil invertebrates.

From whichever direction, or directions, Australia received its ancestral marsupials and ancestral eucalypts, it is certain that many of the marsupials have made good use of the eucalypts for food or shelter. For example, the common Australian opossum lives in the branches of the eucalypts and feeds on their leaves, as do also the koala, or "native bear," and the various flying phalangers. The eucalyptus oil in these leaves would be poisonous to man, at least in large doses, but as these creatures thrive on the diet, their digestive system must have some way of neutralizing the poison.

On the other hand, the typical kangaroos live on the ground and feed on the grass which grows even in the

eucalypt forest. The pigmy musk kangaroo, however, feeds on varied herbage and tends to connect the kangaroos with the phalangers. The latter are a family of Australian marsupials ranging in size from a mouse to a large cat and having thick soft fur. The tail is often long and prehensile, and they are chiefly nocturnal, tree-dwelling creatures.

Huxley, Dollo, and later students of the marsupials have set forth much evidence that all the herb-eating marsupials were derived from tree-living forms that were not unlike the smaller phalangers. All these have the middle pair of lower incisor teeth enlarged, inclined forward, and adapted for gnawing or nibbling. Hence the entire group, including the phalangers, kangaroos, and wombats, is named Diprotodontia ("having two front teeth"), in distinction from the insect- and flesh-eating marsupials, which have numerous front teeth and are therefore called Polyprotodontia.

The polyprotodont group begins with the very small insect- and fruit-eating pouched "mice," runs up through the so-called "native cats" or dasyures, and culminates in the flesh-eating "Tasmanian devil" and "Tasmanian Tiger."

In the bandicoots the front teeth are like those of the polyprotodonts, but the molar teeth are better adapted for chewing all sorts of small food, while the feet are like those of the kangaroos. Thus the bandicoots tend to connect the two main divisions of the Australian marsupials. The plan of the internal anatomy among the polyprotodonts and the diprotodonts also indicates that both have been derived from a remote ancestral common stock, which, as already noted, is nearly represented in the American opossum.

The egg-laying mammals of Australia are even stranger than its marsupials. The most famous of these is the duckbill platypus (*Ornithorhynchus*), which is quite erroneously celebrated as a "link between birds and animals." It is true that it lays eggs and has a ducklike bill and webbed feet; but these birdlike features by no means prove that it has any real connection with birds. It is a true mammal, covered with fur like a seal, feeding its young with milk, and agreeing in its general anatomy with mammals, not birds. It is indeed a survivor of the oldest mammalian stage, in which relatively large eggs

with shells or tough envelopes were still being laid, as they are in turtles, lizards, and crocodiles.

In the female platypus the right and left oviducts, or egg-tubes, remain completely separate, as they do in reptiles. In higher mammals, on the contrary, the right and left oviducts tend to unite more or less completely in the midline, thus producing a true womb or internal pouch in which the eggs after fertilization develop into young and are then "born alive." The other egg-laying mammal of Australia is the "spiny anteater" or "porcupine," which so little resembles the platypus that its relatively close relationship to that animal would hardly be suspected.

The class of mammals as a whole is divided into three subclasses, which are called egg-layers, marsupials, and placentals. In Australia the egg-layers and marsupials had the field almost to themselves. But they did not have it entirely so, because even before the coming of the white man the placental mammals were represented by several marine mammals, such as seals, dugongs, whales, and porpoises, by a wide variety of native true rats, by many species of bats, by the dingo or wild dog, and by the Australian aborigines. If someone should ask why even savage men should be bracketed with dogs, bats, and rats, we may reply that from a scientific point of view man is as truly a mammal as any of the others and that he is moreover a placental mammal. This means that during his development he is surrounded in his mother's womb by a placenta. This is a sacklike organ, well supplied with blood vessels, in which the mother's blood corpuscles can carry food material for the growing embryo and carry off its waste products, although the maternal and the foetal blood currents do not mix but merely exchange their products by osmosis through the walls of their respective blood vessels.

Certain marsupials, especially the koala, have developed a small placenta, but as a rule the young marsupials are born in a relatively early stage of development, so that they resemble unborn stages of the placental mammals.

These placental mammals very early became the dominant forms of life in the Northern Hemisphere, where the marsupials were represented only by the American opossums and a few extinct related types. But in Australia

► **THE FAMOUS DUCKBILL PLATYPUS:** a mammal that hatches from an egg. This is an 8½ weeks old baby—blind, helpless, and covered with a very short growth of satiny fur



D. H. Fleah photos from Black Star

▼ **THE PLATYPUS** has webbed feet and a bill like a duck. In spite of the fact that it lays eggs, it has a coat of fur and feeds its young with milk. This one was the mother of the first baby platypus ever hatched in captivity



Pouched "Mole"



Banded Anteater



Tasmanian "Tiger"



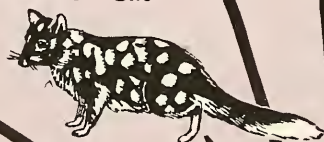
Caenolestes



Tasmanian Devil



Native "Cat"



Borhyaena*



Pouched "Mouse"



Opossum



Grandfather 'Possum and His Family

By WILLIAM K. GREGORY

All of the Australian pouched animals, or marsupials, are believed to have descended from ancient animals of the opossum tribe. There were apparently two main lines of descent among the Australian marsupials. On the one hand, the marsupials having *many front teeth* (Polyprotodonts), range from small pouched "mice" to the flesh-eating "Tasmanian devil" and "Tasmanian tiger." On the other hand, those with *two front teeth* (Diprotodonts) include herb-eating animals such as the kangaroo and the koala. The bandicoots (which have front teeth like those of the Polyprotodonts but feet that resemble those of kangaroos) tend to connect the two branches. The internal anatomy of all indicates a common opossum ancestry.

*Extinct

CAENOLESTOID

MORHYAENOID

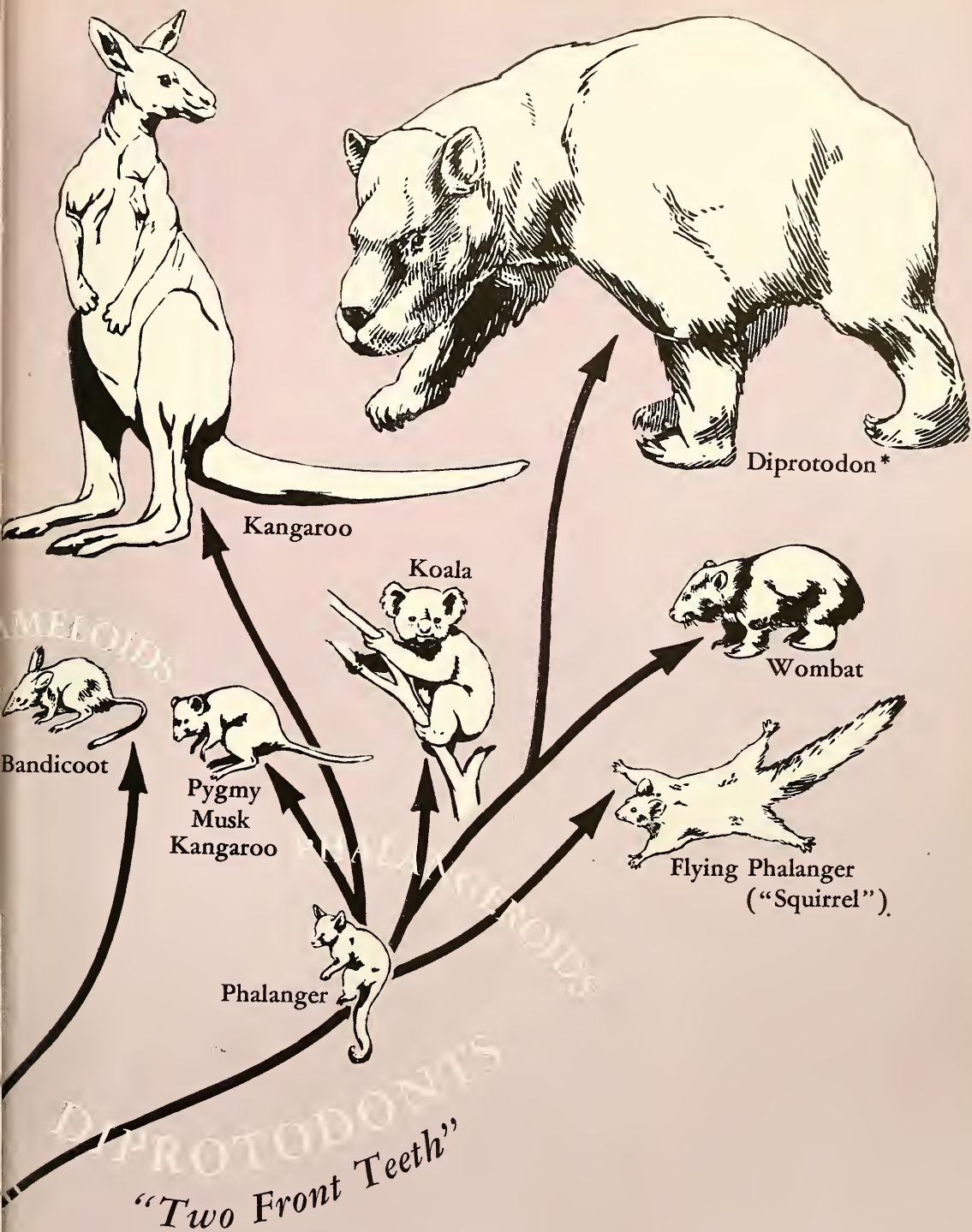
DASYPOD

POLYPROTODONT

PER

DIDELPHOPOD

Cretaceous Opossums





Australian News and Information Bureau photo

▼ AN AUSTRALIAN native hurling a three-pronged fish spear with a throwing stick. The throwing stick is an implement used to add leverage to the arm and speed to the spear. The aborigines of Australia, whose language and social organization are highly developed, provide an interesting link with the era before the Island Continent was discovered by white man

▼ MODERN AUSTRALIA, through the enterprise of its progressive people, is building a nation that excites the admiration of the world

Australian News and Information Bureau photo

the marsupials were the early settlers, and the placentals seem to have straggled in at different times. Perhaps among the first placentals to arrive were the Australian true rats, including the water rats. These are closely related to certain rats of the Philippine Islands. They may have entered Australia from the north and then spread southward, as did the tree ferns, the rain forest, and the "goan-nas" or varanid lizards.

Fossil jaws and teeth of the wild dog, or dingo, have been found in certain Australian caves, associated with remains of some of the giant herbivorous marsupials. The latter animals were widespread in the interior of the country before the present semiarid climate had developed. They and the dingo lived in a period which probably corresponded to the Pleistocene, or Ice Age of the Northern Hemisphere. The molar teeth of the dingo closely resemble those of a certain species of wild dog found in southern India, and there is some evidence (cited by Wood Jones) that the dingo was brought into Australia by the ancestors of the aborigines.

The pioneers of the Australian aborigines must have entered Australia many thousands of years ago. A fossilized human skull which was found in a clay bank at Talgai,

Continued on page 374



Two fishing Cats that made History

By E. W. GUDGER*

Honorary Associate, Department of Fishes,
American Museum of Natural History

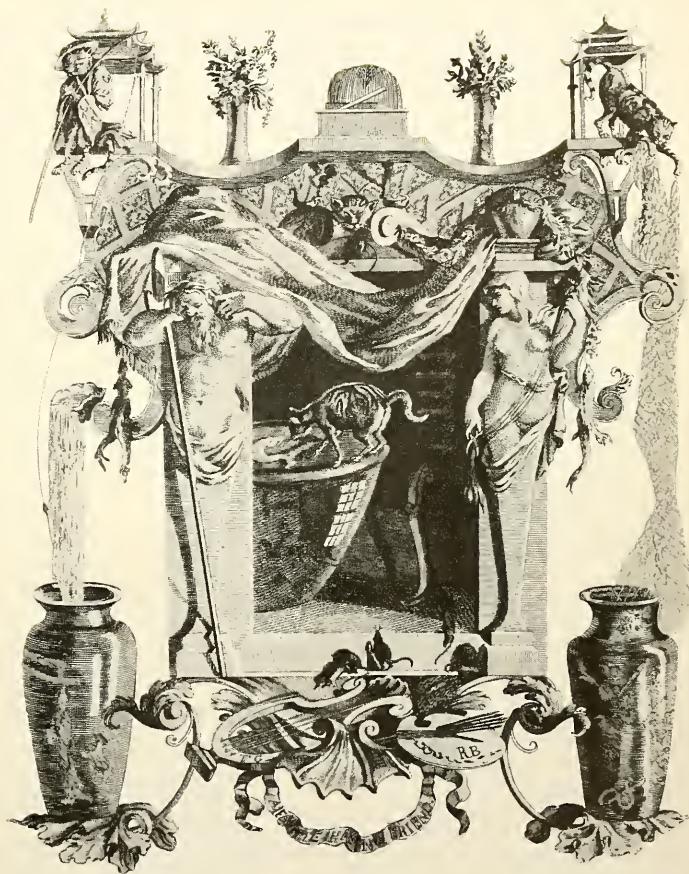
IN 1925, I published in *NATURAL HISTORY* an article—"Cats as Fishermen"—in which it was conclusively shown that cats are passionately fond of fishes, that they do not mind getting their feet wet to catch them, and that they will even go in "all over" if necessary to procure this much-relished prey. Seeking information for this article, I ranged far and wide.

Knowing that the ancient Egyptians cherished cats while alive and mummified and venerated them when dead, I thought that the earliest records of fishing cats might be found in their temple and tomb wall-paintings. But search through the records brought only disappointment. Sir Gardner Wilkinson, in his "Manners and Customs of the Early Egyptians," published illustrations of Egyptian cats accompanying their masters on fowling expeditions and retrieving fallen birds in the lotus thickets. But he nowhere portrays, nor does he even refer to, a fishing cat. Indeed, he strongly doubts whether a cat "could be induced, on any consideration, to take to the water in quest of a fallen bird." And there my search for prehistoric data on fishing cats was brought to a standstill—but not for good.

We do not even now know who first saw a cat (domestic or wild)

One was immortalized in an elegy by Thomas Gray. The other was honored by having the smallest street in the world named after it, in a section of Old Paris where recently some of the most severe fighting has raged

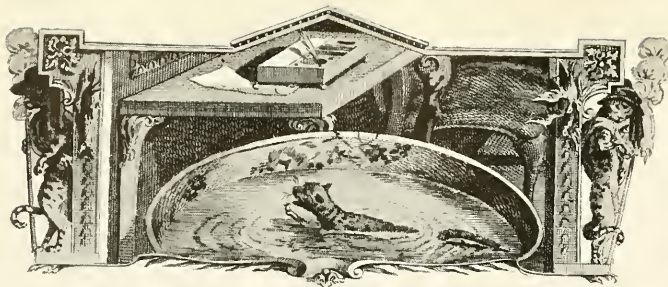
▼ A "DESIGN" by R. Bentley published in 1753 with Thomas Gray's ode to a cat that was drowned "in a tub of goldfish." On the left is a river god with fingers in ears to cut out the cries the cat will make when she falls in. On the right, Destiny is personified cutting the nine threads of the cat's life



*DR. EUGENE W. GUDGER is one of America's outstanding students of fishes. He received a doctor's degree at Johns Hopkins University in 1905. He carried on research on marine fishes for 14 seasons at the U. S. Fisheries Laboratory at Beaufort, North Carolina, and at the Marine Laboratory of the Carnegie Institution in the Tortugas, off the tip of

Florida. His scholarly interests extend far beyond the anatomy, habits, and distribution of fishes, and include extensive inquiries into unusual native methods of catching fish and other scientific lore. He is also greatly interested in the unusual things that fishes do and that are done to them—particularly by their enemies. He compiled Vol. III of *The Bibliography of*

Fishes (1919-1923), a cross-indexed reference book considered well-nigh indispensable by fish scientists, and was editor of the *Bashford Dean Memorial Volume: Archaic Fishes* (1929-1943). He is the author of innumerable technical papers and popular articles. A number of the latter have appeared in *NATURAL HISTORY*.—ED.



▲ IN THE SECOND ILLUSTRATION accompanying Gray's poem, the cat is shown calling for help, unable to climb the smooth glass sides

seeking its prey in the water, nor who first recorded such an action. But recent good fortune started me on a literary-historical search which has brought to light some very interesting things and has enabled me to push the date back about two and three-quarters centuries.

A DESCENT INTO ANTIQUITY

The earliest account of a fishing cat quoted in my 1925 article was from the Spanish naturalist, Felix d'Azara, who lived in Paraguay from 1781 to 1801 and published a great work on the quadrupeds of that country.¹ In Vol. I, Azara relates that in Paraguay the jaguar goes into the water a little way and waits for fish to come near. Then it hurls them out onto the bank by a swift stroke of the paw; and when enough have been captured it eats them.

In England

But antedating even the French edition of Azara, the fishing by a domestic cat had been embalmed in English literature by the celebrated poet, Thomas Gray, who is best known for his "Elegy in a Country Churchyard." The story is an interesting one. In 1747, four years before publication of this other elegy, Gray's friend, Robert Walpole (the younger), lost his favorite cat, Selima, who, seeking to abstract certain goldfish from a glass bowl, fell in and was drowned. Upon receipt of the news, Gray wrote and sent to his friend an ode on the demise of this favorite feline.

"On a Favorite Cat Drowned in a Tub of Gold Fishes" is the first published account (1748) that I know of describing the exploits (and

fate) of a fishing cat. It is too long to quote in its entirety, but certain pertinent lines may well be reproduced:

'Twas on a lofty vase's side,
Demurest of the tabby kind,
The pensive Selima, reclined,
Gazed on the lake below.
Her conscious tail her joy declared:

She saw and purr'd applause.

Still she gazed, and midst the tide
Two angel forms were seen to glide,
The Genii of the stream:
Their scaly armour's Tyrian hue

Betrayed a golden gleam.

A whisker first, and then a claw

She stretch'd, in vain, to reach the prize

What Cat's averse to Fish?

Presumptuous maid! with looks intent
Again she stretch'd, again she bent
Nor knew the gulf between—

The slippery verge her feet beguiled;
She tumbled headlong in.

Eight times she emerged from the flood crying for help, but none came and, her ninth life having been sacrificed, poor Selima passed from the scene.

This elegy was first published without illustrations, but in 1753 it and five other poems by Gray appeared with "Designs by Mr. R. Bentley," which, so far as I know, are the first published illustrations of such a happening. For this reason and because of their inherent interest they are reproduced here.

In the center of the first "design" is a cat standing on the brim of a large glass bowl or "tub" and endeavoring to catch a goldfish. On either side is a caryatid. That on the left represents a river god with fingers in ears to cut out the cat's cries due shortly, the one on the right portrays Destiny cutting the nine threads of Selima's life. At the bottom are four mice enjoying themselves at the pros-

▼ THE MYTHICAL FERRYMAN CHARON is taking the cat across the Styx in the third illustration accompanying Gray's elegy to the unfortunate cat. When the ghostly cat sees Cerberus, three-headed guardian of the lower regions, she arches her back and fluffs her tail



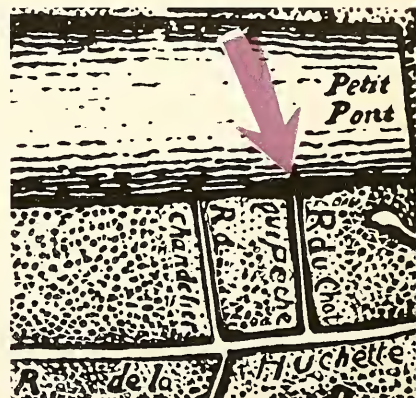
¹This work was published in French in Paris in 1801, and in Spanish at Madrid in 1802. An English version was brought out in London and Edinburgh in 1938.



▲ THIS EXCERPT from an old map of Paris shows that as early as 1675 The Street of the Fishing Cat was recognized. The name was apparently applied when a flood of the Seine brought water and fish into the adjacent cellars, enabling a local cat to get in some good fishing. At right is an enlarged section

▼ AN AERIAL VIEW of modern Paris shows the position of the quaint little street in relation to Ile de la Cité and Notre Dame Cathedral. The river end of the street is said to command one of the best views of the Cathedral. It is perhaps the shortest and narrowest street in the world, but in the Paris street guides it occupies as much space as the Champs-Élysées. This section was recently the center of armed French resistance which resulted in the expulsion of the Germans from Paris

Press Association, Inc.



pect of the cat's demise. The other parts of the drawing, being less relevant, need not detain us. The next drawing shows the cat floundering in the "tub," crying for help and almost at the point of giving up her last life. Two other cats, with the funeral outfit of hats, staves, and sashes, act as prospective mourners. And the tail-piece to the elegy shows Charon ferrying Selima's ghost across the Styx. But at the sight of the three-headed Cerberus awaiting her, the ghost arches her back, fluffs out her tail, and snarls at the dog—a typical feline reaction.

In France

Gray carries the date of the fishing cat story back to a fair degree of antiquity (1747). But a fortunate "tip" has resulted in pushing the date back at least 75 years earlier. So now from England we cross the Channel to the fair land of France, in whose capital city there is a little

street with a fascinating name. The clue came in the form of the title of a book written by Jolán Földes—*The Street of the Fishing Cat*. The book proved to be about life on a street of this name in the center of Paris, but it gives no information as to how or when the street was named. However, I was assured by friends who have been in Paris that there is and evidently has long been such a street in that city.

To one of a bibliographical bent this was like a fresh scent to a bloodhound, and it started me off on an exciting bit of antiquarian and historical research, particularly in books professing to give the history of the streets of Paris. Working from one book to another, I have gathered quite a lot of interesting and corroborative data about this street and how it came to be named.

"The Street of the Fishing Cat" (*Rue du Chat qui Pêche*) is on the south bank of the Seine opposite the Ile de la Cité, and is in the very heart of old Paris. This island in the Seine was from the beginning a natural stronghold. It was at first a palisaded town of the Gallic tribe of the Parisii—whence the name of the City. Caesar speaks of it in his Commentaries (written about 50 B.C.). The *Rue du Chat qui Pêche* is today probably the narrowest and shortest street in the world ("as short as a rabbit's tail")—"about 30 paces long by two wide." It is so narrow that the pav-

ing consists of six or eight cobblestones in a row from house to house. It formerly extended from the *Rue de la Huchette* to the bank of the river, but since an embankment has been built along the Seine it now extends onto the *Quai St. Michel*. It gets its name from the alleged fact that in the old days, when the floods in the Seine subsided, a cat which lived on this street used to catch fishes stranded in the cellars along the river, and one authority states that there was formerly in the vicinity a shop bearing a sign of a fishing cat. It has been an interesting bit of historical research to trace street and story back to their beginning.

The authorities state that in 1540, the street afterwards known as *Rue du Chat qui Pêche* was called *Ruelle des Etuves* and later *Rue du Renard*. In the library of the American Geographical Society in New York, I have been shown a number of facsimiles of plans of old Paris. One dated 1551 shows the street going through but without a name. However, one in 1675 shows the street bearing the name as written above. Now in 1658 there was a great inundation of the Seine, which flooded the *Ile du Palais* (as it was then called) and the banks adjacent. It did great damage, carrying away various bridges with the houses built upon them. More explicit on this matter, there is extant a rhyming communica-

tion from the dramatist Scarron to his friend Pelisson in which he states that during the flood of 1658 the stables and cellars of the houses along the Seine were flooded and became reservoirs for fishes, whence they were taken with the hook—and presumably by the fishing cat. At any rate the facsimile of the plan of Paris dated 1675 shows the street designated *Rue du Chat qui Pêche*. From this it is clear that the story and the name of this street date from at least as early as 1675 and possibly nearer to 1658, in the middle of the reign of Louis XIV.

The illustration reproduced here showing this street is an enlargement of the area around and including the *Rue du Chat qui Pêche* made from the facsimile of the 1675 plan of Paris above noted. So far as I can find, it is the oldest published allusion to a cat fisherman, and the story has sufficient historical interest to be worthy of this short note.

It is a matter of no small interest that the exploits of a fishing cat led to the naming, at least as early as 1675, of a street in the heart of old Paris. And it is particularly interesting that this name, in spite of the passage of 269 years, is still the official designation of the same little street. But in view of the events that have recently taken place in the French capital, one wonders of this quaint little street has survived the destruction of war.

AUSTRALIA—THE STORY OF A CONTINENT

Continued from page 370

Queensland, is essentially Australian in its receding forehead and projecting muzzle. The clay bank in which it was found is regarded by good authorities as having been laid down during the Pleistocene Period.

Another fossil skull found at Co-huna, Queensland, is also unquestionably of aboriginal Australian type. The fossil Wadjak skull found in Java was regarded by its discoverer, Dr. Eugène Dubois, as of proto-Australian type.

The Todas and other wild or "pre-Dravidian" tribes of India and Ceylon resemble the Australians in their dark skins, abundant wavy hair, and broad noses, and it is probable that at least part of the mixture that gave rise to the Australian aborigines came from this direction. Another contributing element was the Melanesian type.

This was predominant in the natives of Tasmania, who were exterminated by the white settlers there.

Although the Australian aboriginal is often spoken of as the lowest of existing forms of mankind, his retreating forehead, projecting brow ridges, and extremely wide nose are found in association with very remarkable mental ability in certain directions. The surviving aborigines of the desert interior of Australia have a most intimate, extensive, and useful knowledge of the plant and animal life in their harsh environment, and they are highly expert trackers, hunters, and trappers. Their material equipment is necessarily simple, for they wander over wide areas in search of food, but their language, mythology, ritual, and general social organization are highly developed and of such a degree of complexity as to command the respect and enthusiasm of anthropologists. More-

over, their imagination, their dramatic sense, and their decorative art are all well worthy of admiration.

Unfortunately the contact of the aboriginal people and their culture with white civilization has too often proved disastrous to them. At least the only aborigines that survive in any numbers today are those that have retreated far into the wilderness.

Such was the island continent, full of a thousand mysteries and adventures. The northern and northwestern parts of it were touched by several early navigators, including Tasman (1642) and Dampier (1688, 1699). But it remained for Captain James Cook on April 28, 1770, to land at Botany Bay on the east coast and to formally raise the flag of his sovereign. What exciting chapters of the human comedy then began to unfold! The horrors of the convict ships, the struggles and privations of the early

Continued on page 384

FROM STAPLES



TO SPICES

Man as a planter of seeds has reached new heights in the current struggle to raise crops vital to victory.

WHILE not strategic in the same sense as fibers, rubber, vegetable oils, insecticides, and certain drugs, the plants that furnish man with food and drink or make his food more palatable are in some ways even more essential. The fighting men on the fronts must have the proper food, or all the fiber and rubber and armaments in the world will be of no value to them. So, also, the millions of men and women behind the lines — the WACS and WAVES and SPARS, the members of the heroic Merchant Marine, those operating the hospitals and the supply lines to and from the fighting front, and the men and women who

constitute the tremendously important home front, on whose morale that of the armed forces often very largely depends—all these must eat. And in the stress of war time, with the added strains of longer hours, harder and often unaccustomed work, speed, worry, tension, and heartache to wear down one's physical stamina and resistance to disease, plenty of nourishing and appetizing food becomes more vital than before.

In these days of total war and the scorched-earth policy, fighting forces can no longer live off the country as they did in ancient and medieval times. Food now has to be brought to the armies from lands far from

[[THE CONCLUDING ARTICLE IN A SERIES ON STRATEGIC PLANTS]]

By HAROLD N. MOLDENKE

◀ **WHEAT**, first grown in the region of the Nile Valley almost 7000 years ago, is still pre-eminent among grains. The yield per acre is abundant; wheat is easily stored and transported, and it is superior for bread because of its high gluten content

By Gladys Dising from
Free-Lance Photographers Guild

the scene of conflict, and also to the starving populations of the countries in which the fighting is taking place. A large proportion of the earth's population is at present facing starvation and will continue to face it until long after the actual fighting has ended.

The Indians of North and South America employed about 1800 native American plants for food and drink, some of which, like the potato, sweet potato, maize, tomato, peanut, pumpkin, kidney bean, lima bean, and squash, are still staples in our diet. But of all the foodstuffs man consumes, the cereals are by far the most important. They furnish the largest quantity of calories. While in America cereal foods usually contribute less than a third of the calories in the normal diet, in most of Europe they furnish over 50 per cent, and in Asia over 75 per cent. The most important cereal crops are wheat (*Triticum aestivum*), rice (*Oryza sativa*), barley (*Hordeum vulgare*), maize (*Zea mays*), oats (*Avena sativa*), rye (*Secale cereale*), sorghum (*Sorghum vulgare*), and their many varieties. It is estimated that the normal world production of wheat in a good year is about 6 billion bushels, of corn 4½ billion, of oats 5 billion, of rye 2 billion, and of barley 2½ billion bushels. About half of the cereal production of the world normally goes to the feeding of domesticated animals, the remainder to human consumption. The portion consumed by domesticated animals is, of course, essential in providing meat foods.

The world produces about 7 billion bushels of rice yearly, and everyone is aware of the tremendous importance of this food to the people of southeastern Asia. In the economy of the Western Hemisphere, the position of rice is not so generally realized. Cuba is the largest rice deficient country in the New World, and smaller

amounts are imported by Canada, Bolivia, Honduras, Peru, and Venezuela. The main Western Hemisphere countries producing enough for export are Brazil, Ecuador, Chile, and Mexico. The United States produces a surplus of about 400 million pounds. In total, the New World is producing just about enough rice to meet its present needs.

Wheat and rye flour offer a unique advantage in that they can be baked in loaves of yeast-leavened bread. This is due to their high gluten content, which is not possessed by the other cereal grains. The latter are therefore used only in the form of flakes, grits, groats, and meals, and are prepared for eating by baking as biscuits, boiling, steaming, or as alimentary pastes.

Another important group of food plants is the legume family, including lentils, peas, and scores of varieties of beans. Though poorer in starch than the cereals, legumes are richer in proteins and can therefore be used as substitutes for meat. This property makes them of special importance in heavily populated regions like China and India and in other regions where the meat supply is low.

Among the legumes the soybean (*Soja max*) takes high rank. In Asia it has always been one of the principal foodstuffs. Now it is becoming ever more popular in America. Candy-makers are using toasted soya grits to replace coconut on marshmallows and chocolate bars. Bakers and confectioners employ soya flour as a substitute for condensed, evaporated, or powdered milk. And because of the high protein value restaurants put soya grits into meat loaves and croquettes as a stretcher. Flaked soya kernels are being marketed as a ready-to-eat breakfast food, and soybean flour goes into baby foods, macaroni, and cake flour. The dry beans furnish soy sauce, soup mix, and soy cheese. The sprouts have even more vitamins than the bean itself. As a milk substitute the soya can be cooked like milk or cream and it makes a remarkable coffee substitute. It is stated that the proteins of the soybean and of the peanut (*Arachis hypogaea*) are the only complete plant proteins. Rich in vitamins and minerals, they are the most valuable of all the legumes as meat substitutes. The use of soybean and peanut oil as substitutes for coconut oil, which is now scarce, has been referred to in a previous article.



▲ SUGAR CANE is thought to have originated in India. It was shipped to Europe about 500 A.D. and was planted in the New World soon after the arrival of the Spaniards. Thence, more recently, it was introduced to Hawaii, where it is here shown, after almost a complete circuit of the globe

Many plants store up rich deposits of foodstuffs in their roots, corms, bulbs, rhizomes, and other underground parts. Among the most important of these plants are the potato (*Solanum tuberosum*), sweet potato (*Ipomoea batatas*), sugar beet (*Beta vulgaris* var. *alba*), cassava (*Manihot esculenta*), sago (*Metroxylon*), and taro (*Colocasia esculenta*). The underground foodstuffs are largely carbohydrates and quite farinaceous or mealy in texture, containing in their raw state only small amounts of protein and still less fat. When refined in the process of manufacture they are almost pure starch or sugar. They are consumed in a fresh state as vegetables, but in the dry state they are even more valuable because of their concentration and practically nonperishable nature.

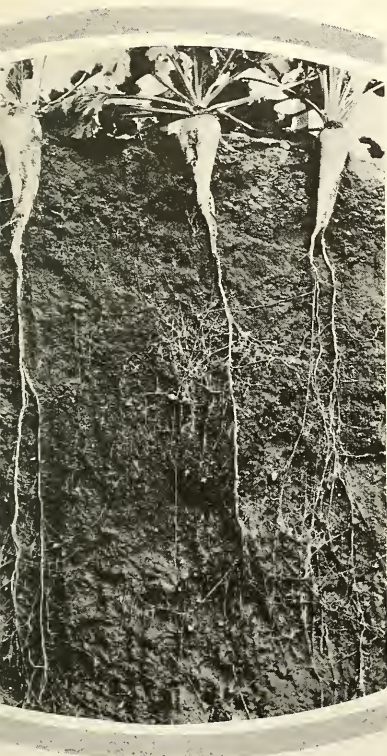
Potatoes are of outstanding importance in Europe and North America, where the annual crop is over 100,000,000 long tons. Though of limited transportability because of their perishable nature, potatoes are highly valuable in these areas as a human and animal food and in the manufacture of alcohol.

Approximately 30 million long tons of sugar are produced and used annually in the world, of which about two-thirds come from sugar cane (*Saccharum officinarum*) and one-third from sugar beets (*Beta vulgaris* var. *alba*). There is no chemical difference between the sugar from the cane and that from the beet, but in general the beet sugar industry is one of temperate climates, the cane sugar industry one of tropical lands. India is thought to be the original home of cane sugar, whence it was shipped to Europe in 500 A.D. It was introduced into the West Indies in the late 15th century soon after the arrival of the Spaniards and gradually spread throughout tropical America.

The presence of sugar in beets was discovered in Germany in 1747, and especially between 1800 and 1815 attempts were made to obtain sugar commercially from beets. By 1879 the United States had established the first factory from which the present sugar beet industry may be said to have grown. Today the New World produces about one-third of the world's supply of sugar. In the United States $\frac{3}{4}$ of the annual output comes from

beets grown in north-central and western states, and $\frac{1}{4}$ from cane grown in southern Florida and Louisiana. All Canada's production comes from beets, while that from Latin America is almost wholly from cane. Cuba is now exporting more sugar than any other country in the world and is second only to India in total production. The total produced in continental United States is about 2,000,000 tons a year or only about 30 per cent of our annual requirements. About 25 per cent comes to us from Puerto Rico and Hawaii, and before the war another 15 per cent came from the Philippines. Cuba normally supplies most of the remainder, with a little also coming from the Dominican Re-

▼ **WORM'S-EYE VIEW** of sugar beets ready for harvest. The main roots drive six or seven feet into the earth and send out many smaller roots



Photos from Ewing Galloway

► **ONE-THIRD** of the world's sugar comes from sugar beets. Beet sugar is chemically identical with that from cane. This is a scene in a beet sugar warehouse at Ogden, Utah

public and Peru. Canada raises enough to meet $\frac{1}{4}$ of her needs and imports the rest from Cuba.

The sugar beet is an annually planted crop in America. The seed is planted in the spring and the beets are harvested and processed in the fall. Sugar cane, on the other hand, is a perennial, and 12 to 18 months are required before a crop can be harvested. The cane may be planted in both the spring and the fall, and in many areas a single planting will yield 5 to 10 crops in as many years. The harvest of the cane usually begins in December or January in the northern Latin American countries and in June in the southern ones. Very important by-products are blackstrap molasses and bagasse. The former is widely used in the production of industrial and fuel alcohol, in the manufacture of yeast, acetic acid, and other chemical products and as livestock feed. Bagasse is the ground-up or crushed cane fiber left after the juice is extracted. It is used extensively as a fuel to operate the sugar mills and also in the manufacture of wall board and similar products. A relatively new sugar product is high-test molasses, used for making industrial alcohol. It is obtained from cane from which no sugar has been extracted and is of great importance now because of the demand for alcohol in the war industries.

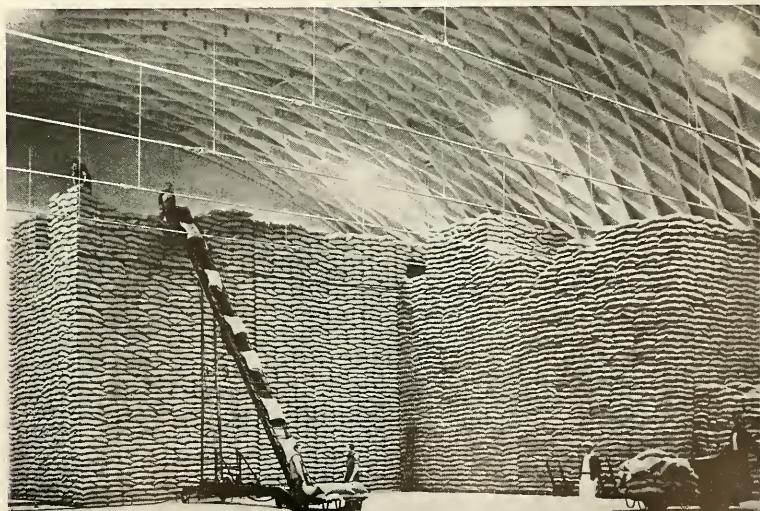
Sorgo or sweet sorghum (*Sorghum vulgare* var. *saccharatum*) is a crop which is now being pushed vigorously in the United States. Sorgo seems to have originated in China, where it has been cultivated so long that its

wild ancestors can no longer be identified. But the Chinese, having an abundance of cane sugar, never pressed sorghum for its juice. The plant was introduced into France in the early 1850's and into America a few years later. It has always proved popular and valuable during wars when the supply of cane sugar has been inadequate.

Agricultural scientists believe that they have finally overcome the unevenness of sorghum sirup and its refusal to crystallize into sugar because of the presence of gummy substances, which hitherto caused this crop to have an unreliable status. The crop's average yield per acre in 1941 was 61 gallons of sirup, compared with about 162 for cane sugar. Sorghum, however, is ready for processing after 3 or 4 months, while sugar cane requires 12 to 16 months. Unlike sugar cane, it can be grown almost anywhere. The plants grow from 5 to 12 feet tall.

The food value of sorghum sirup is considerable. It is the only sweetening used in many rural sections, where it is an important source of vitamins and minerals in an otherwise deficient and monotonous diet. It contains twice as much iron as sugar cane molasses. Experiments on the production of sorgo for industrial alcohol were conducted on an extensive scale as a war project in Louisiana in 1942.

Last autumn 15,000,000 families in the Soviet Union got their first taste of California lima beans, Connecticut corn, Idaho peas, Indiana spinach, and Minnesota eggplant—all grown on their own soil. Behind



this startling fact is one of the most interesting and important stories of international co-operation in this war. As we read daily of the Soviet advances toward Berlin our attention is concentrated on the fighting front. But Russia, like every other warring nation, has had to fight two other battles, both behind the front. One of these was the battle of production, the other the battle of food. The farmers and seed growers of America have played a major role in this latter battle by their contribution of vegetable and field seeds. Last spring 3,500,000 pounds of seeds were shipped to the Soviet Union. From now until long after the end of the war this production of seeds and their shipment to war-torn lands will be an important American occupation.

In ancient and medieval times smoke and salt were the only means man had for preserving his food from decomposition. Spices were often required to make meats palatable, and they were thus more valuable and precious than gold. Among the most fabulous treasures of the East were the spices. We in America should be the last to forget the importance of spices, for Columbus, sailing westward to discover a new route to the Indies and their precious spices, discovered America. Today, hermetically sealed tin cans and refrigeration preserve the natural flavors of foods so effectively that spices are not as important as of old, but they remain a piquant addition to modern menus, and it becomes a matter of general concern when the principal producing areas are cut off from world trade as they have been by the present war.

Some few of the condiment spices can be grown in temperate regions. Among these are black mustard (*Brassica nigra*), parsley (*Petroselinum crispum*), marjoram (*Marjorana hortensis*), sage (*Salvia officinalis*), dill (*Anethum graveolens*), thyme (*Thymus vulgaris*), fennel (*Foeniculum vulgare*), caraway (*Carum carvi*), and coriander (*Coriandrum sativum*). Even so, the United States does not produce sufficient quantities of sage, thyme, fennel, caraway, and coriander to meet normal pre-war requirements. Indeed, only mustard (the yellow or white variety and the brown) can be said with certainty to be produced in adequate quantities.

The majority of the spices are tropical crops which cannot be grown in

our country, and the most important is black pepper (*Piper nigrum*). As a recent writer has pointed out, "Commonplace as pepper is today, there was a time when only kings and the wealthiest nobility could afford its use. In Rome during the first centuries of the Christian era it was measured out in balances for its equivalent weight in gold. Perhaps nothing that we eat has had a history so long and turbulent as the tiny clustered fruit of the pepper vine." Black pepper is at present not successfully grown anywhere in the Western Hemisphere. White pepper is obtained from the same vines by picking the fruit clusters before they are fully ripe, soaking them in water, and removing the black outer rinds before drying and grinding. The United States before the war imported over 50 million pounds of black and 6 million pounds of white pepper annually. Production is heaviest in Sumatra (up to 80 million pounds a year) and India (40 million pounds).

Cinnamon has always ranked as one of the chief spices. It is obtained from the inner bark of *Cinnamomum zeylanicum* and *C. loureirii*, native to Ceylon. Cinnamon has been known from remote antiquity and was highly prized among ancient nations. Its history furnishes an excellent example

of the tactics that have often been employed to guard the established spice-producing areas from foreign competition. The Dutch, when they were in control of Ceylon, made it a crime punishable by death to export any seeds of the tree from the island. It is chiefly because of measures like this and because of the scarcity of cheap labor, that the cultivation of many of the spices has been so slow in other regions of the world.

Related to cinnamon is the wild cassia or cassia-bark (*Cinnamomum cassia*), a native of China. True cinnamon bark has a more delicate flavor than cassia, but far greater quantities of the latter are grown and sold at a cheaper price. The tree may attain a height of 50 feet and a trunk diameter of 5 feet, while the cinnamon grows to 40 feet high and 2 feet through the trunk. Under modern cultivation both are made to grow like bushes. At the age of 2 to 6 years the bush is cut off at the ground. From the stump will grow sprouts that are then cut off every 2 years in the same manner. From the thin dried bark of these young shoots are produced the sweetest cinnamon and cassia quills.

Another of the historic spices is the clove, taken from the tree *Eugenia aromatica*, native to the Moluccas or

▼ A PEPPER PLANTATION in Malaysia, representing an agricultural industry which stimulated early exploration of the Far East and has greatly influenced social and political life in those areas

Photos from Ewing Galloway



Spice Islands, between the Philippines and Australia. The Portuguese were the first to discover cloves, but in 1605 they were driven from the Moluccas by the Netherlands, who in a manner characteristic of the times went to great lengths to obtain a monopoly of the clove trade. They undertook to exterminate all clove trees on the islands to which they were native and to concentrate their cultivation on the Netherlands islands of Amboina and Ternate, where they could be carefully guarded. In 1769 and 1771 French expeditions from Mauritius managed to discover a few trees overlooked by the Netherlands in their "scorched-earth" operations. Brought to Mauritius, they were then introduced to Zanzibar and Pemba, off the eastern coast of Africa, where 80 per cent of the world's supply is grown today, although before the war competition from Java and Sumatra was very severe.

The clove is a beautiful evergreen, growing to a height of 40 feet, with large oval leaves and crimson flowers in numerous terminal clusters. The tiny dried flower-buds are famous for their flavor and fragrance and are of importance also as the source of clove oil, used medicinally and in soaps, perfumes, and ointments. The chief ingredient of cloves is called

eugenol and is the basic material from which synthetic vanilla extract is made. It is familiar to us all as an ingredient in the lure in Japanese beetle traps. Ground cloves are also sometimes used by cigarette manufacturers because of the delicate fragrance they impart to tobacco.

Also native to the Moluccas is the nutmeg tree (*Myristica fragrans*), an evergreen tree attaining a height of 60 feet. The male flowers are on one tree and the female on another. It is said that almost the entire surface of the Molucca Islands is now planted with nutmegs, which thrive in the shade of the lofty *Canarium commune* trees. The nutmeg seed grows within two shells and is enveloped in a sweet membranous crimson aril in the form of a mesh, which constitutes the more valuable spice known as mace. Several hundred pounds of nutmeg seeds will often yield only a single pound of mace. In 1938 more than half of the 4 million pounds of nutmegs imported by the United States came from the British West Indies.

One of the most subtly aromatic and expensive of the spices is cardamom, derived from *Elettaria cardamomum*, native to the East Indies. Fortunately a large quantity is grown in Central America, particularly in

Guatemala. The expensiveness of cardamom is due chiefly to the extreme care that must be exercised in handling it to preserve its very mild and delicate flavor, which is lost upon exposure to the air. The tiny seeds are produced in paper-thin capsules. Each featherweight capsule must be individually cut from the plant and retained unbroken from that time until it reaches the hands of the housewife in her kitchen. This requires cardamom to be handled with more than kid-glove care!

Vanilla is extracted from a Mexican vine, *Vanilla planifolia*, of the orchid family, and was one of the first gifts of the New World to the Old. Because of the delicacy of the plant and its exacting requirements of climate, soil, rainfall, shade, and pollination, vanilla cultivation is among the more difficult forms of tropical agriculture. Before the war about two-thirds of the world's supply came from Madagascar and one-third from Mexico. Since 1935, however, Mexico has doubled its annual production and is now our principal source.

The vanilla vine cannot endure too much direct sunshine and so is cultivated under sufficiently large trees to provide the necessary shade. The seeds or young plants are set beside

▼ **SORGO OR SWEET SORGHUM** produces a sirup containing twice as much iron as sugar cane molasses. The plant has been grown in China so long that its wild ancestors can no longer be identified. It was introduced into America less than a century ago

▼ **THE MAKING OF SORGHUM SIRUP** is a familiar sight in many rural sections in autumn. A scene in Tennessee



small saplings or a high stake to which they are tied with a strip of bark. In a short time the young vine will send out its own holdfast roots, like English ivy. The vanilla plant is propagated almost entirely from cuttings, but when seeds are wanted, a difficult process of pollination must be performed by hand. The industry in Mexico is controlled by the Totonoco Indians, who have become very skillful in artificially pollinating the flowers.

The seed-pod, resembling a large lima bean, is the only part of the plant harvested. The characteristic vanilla odor develops after the pods have been dried, and this drying requires careful handling by experts. Among the ancient Aztecs vanilla was so highly prized that it was one of the tributes that subject tribes laid at the feet of the emperor. It is grown also in Guadeloupe, Puerto Rico, Reunion, Tahiti, the Comoro Islands, Seychelles Islands, Netherlands Indies, and French Oceania. There are about 51 species of *Vanilla*, but none is as valuable commercially as *V. planifolia*, whose flowers are yellow with pale green sepals, somewhat resembling a tuberose.

Since the war a synthetic vanillin has been widely used. For this the raw material may be either eugenol from imported clove oil or two domestic products, guaiacol (a coal-tar product) and lignin (a by-product of the wood-pulp industry). Synthetic vanillin is usually flavored with tonka bean extract (from the South American leguminous tree, *Dipteryx odorata*) or a similar material, and may be used as a substitute for natural vanilla extract or mixed with it in varying proportions. The natural vanilla is, however, still preferred by many, even though much more expensive, and in recent years the United States has been importing about 1,000,000 pounds of vanilla beans per year, valued at \$2,500,000.

Ginger is derived from a tropical Asiatic plant, *Zingiber officinale*, which was early introduced into the New World and by 1547 was growing in such quantities in Jamaica that more than 22,000 pounds of its dried underground stems were exported. At the present time ginger is one of the most important of the Old World spices in the Americas. It is stated that the soils and climate of many Caribbean countries are unsurpassed for the production of this adaptable

and easily cultivated plant, which yields 700 to 1500 pounds of dried spice per acre annually.

The leading example of a native American spice that "made good" in the face of Old World competition is allspice (*Pimenta officinalis*), a native of the West Indies. Its unique name is derived from the fact that its fragrance and taste curiously resemble a mixture of its three chief rivals—cinnamon, clove, and nutmeg. Allspice trees have a span of life longer than man. They commence to bear at from 7 to 10 years of age and when mature yield about 100 pounds of dried spice annually. Allspice is widely cultivated in the West Indies and Central America and offers one of the best cash returns among spice crops.

Among other tropical American spices are the "peppers" or capsicums, of which there are scores of varieties, ranging from the succulent and sweet bell pepper (*Capsicum frutescens* var. *grossum*) to the hottest tongue-scorching Mexican bird chili (var. *longum*). As has happened so often with commercially valuable American plants, most of the spices derived from native American capsicums have been imported by us from outside the Western Hemisphere. The non-pungent paprika, one of the best-known of these spices, was imported before the war exclusively from Hungary, where it was prepared by removing the sharp-tasting core and grinding the pod of the bonnet pepper (*C. tetragonum*). Cayenne and other pungent red peppers are produced from the dried pods, seeds, and pith of other capsicums.

No less romantic than the European search for spices is the world saga of coffee. According to legend, a Greek Orthodox monk in the early Christian era, living in a monastery in Arabia, discovered the coffee bean (*Coffea arabica*) by chance one morning while herding his goats. He observed the goats cropping a certain green bean which made them suddenly frisky. A brew from these beans rendered him wide-awake in the early morning hours when all his confreres were still drowsy.

Coffee was introduced into Europe by the Turks at the siege of Vienna in the seventeenth century. In the next century the sale of coffee in Europe was subject to the whims of Turkish, Genoese, and Venetian commercial expeditions, which could ob-

tain supplies only after long voyages around the Cape of Good Hope. In 1714 the mayor of Amsterdam gave Louis XIV a precious gift of a small coffee plant. This was planted and carefully nurtured in Paris by the famous botanist Jussieu. Nine years later cuttings were put in a sealed glass case and placed on a ship bound for the French colonies in the New World. A Dutchman attempted to sabotage the project by opening the case. Then the ship was attacked by pirates and almost wrecked by a hurricane. Through it all the captain protected the rare coffee plants. At Martinique he set them out and a year later began to gather his harvest, dividing the beans among the farmers of the island. This was the start of the coffee industry in America. Now Brazil is the world's chief producer, and coffee is to Brazil's economy what cotton is to our South. Coffee accounts for a third of Brazil's exports, and the United States purchases over 9 million bags a year. Lack of shipping space has from time to time presented a problem. Among the many substitutes and stretchers used are chicory, roasted malt, rye, barley, wheat, peas, peanuts, soybeans, and sugar molasses. In Holland roasted tulip bulbs are ground up and used as a coffee substitute. The French use roasted oats.

Yerba maté (*Ilex paraguariensis*) is being recommended widely as a substitute for tea. True tea is derived from *Thea sinensis*, native to China and India, and its importation has now been virtually stopped because of the war. A plantation of Chinese tea is being established in Peru, and young tea plants are being distributed at cost to farmers there to encourage tea growing. A scientific periodical recently reported that the yaupon (*I. vomitoria*) of our southern states may come to figure more or less seriously in the American beverage picture. Its leaves have a relatively high content of caffeine, and it was seriously considered as a commercial possibility during the first World War, when shipping shortages nearly cut off our most popular of soft drinks.

Thus, in time of plenty as well as in famine, in war and in peace, on the fighting and the home fronts, we see that many plants—far too many to be adequately discussed in a brief series of articles such as this—are of strategic importance to man and his vaunted civilization.

YOUR NEW BOOKS

NAVAHO DOOR • ARISTOTLE • PEST CONTROL
SPEED IN ANIMALS • FUTURE POPULATIONS

THE HOME LIFE OF THE ANCIENT EGYPTIANS

- A Picture Book by Nora E. Scott
Metropolitan Museum of Art, 25 cents

THIS brochure of some 26 pages and 35 pictures presents a fascinating glimpse into the life of the well-to-do-Egyptians of three or four thousand years ago. The objects of daily living which are illustrated are drawn from the Metropolitan Museum's own collection. The modernity of many of them is startling, and they bear witness to the remarkable stability which the common objects of life have maintained through thousands of years of use.

The topics briefly described include the family, the house, housekeeping, furniture, table ware, toilet and dress, games and toys, and music and dancing. Although these by no means exhaust the variety of Egyptian life, they do make a pattern of living that is distinctive. This is a useful and elementary booklet.

H. L. S.

ARISTOTLE: Generation of Animals

- - - - - Translated by A. L. Peck
(Loeb Classical Library)
Harvard University Press, \$2.50
607 pages

NO student of natural history should be able to say, as so many unfortunately can, that he has never read a line of Aristotle, nor should he think of the first great naturalist only in terms of his famous mistakes. In many ways the *Generation of Animals*, which this edition now makes available in a fine translation at a reasonable price, is the greatest of Aristotle's biological treatises. We have but recently begun to catch up with the theories of embryology advanced in this work, and some of the observations in it are still to be repeated by modern investigators. This book is not only the first treatise on embryology that has come down to us, it is also an expression of Aristotle's philosophy of life, his doctrine of causes and his conceptions of form, necessity, and other matters. Thus it serves as an introduction to deeper philosophical matters, and the critical notes, outlines, and appendices provided by the translator should be excellent guides for those who are unfamiliar with Aristotle's way of thinking.

It is not only for its philosophy or its foreshadowing of the fundamental advances in modern embryology, however, that the *Generation of Animals* is worth reading. In these pages will be found the first observations of the placental dogfish, the strange phenomenon of hectocotyli-

zation in the octopus, the reproduction of bees, and the distinctions between viviparous, oviparous, and oviparous reproduction. For the unfortunate impression that many still have of Aristotle, we must blame the Schoolmen of the Middle Ages, who set him up as their last authority and stuck by his errors even more valiantly than his truths, somehow failing to read such characteristic expressions of Aristotle's attitude toward knowledge as this: "but the facts have not been sufficiently ascertained; and if at any future time they are ascertained, then credence must be given to the direct evidence of the sense more than to theories,—and to theories too provided that the results they show agree with what is observed."

J. W. HEDGPETH.

PEST CONTROL IN THE HOME GARDEN

- - - - - by Louis Pyenson
The Macmillan Company, New York,
\$2.00, 190 pages, 111 illustrations

THE home garden, as envisaged in Doctor Pyenson's concentrated publication on the diseases and pests of plants, could be a rather pretentious enterprise. It might contain the entire list of fruits and vegetables that are commonly grown. If it does, the answer to pest problems will be found in this book, and the identification and control of the pests will be simplified by the 111 illustrations.

While the diseases and pests are obviously those occurring in the northeastern fourth of the United States (many of which are, however, nationwide in distribution), the control measures will apply to other insects of similar habits, regardless of where they occur. The control recommendations are those generally offered by authorities on the subject, and they are designed to give maximum control and procure the greatest amount of high quality produce. Mammal enemies are included, and so are insect friends, also arthropods that may injure man.

Some of the control measures recommended, particularly those pertaining to ants and rats, may prove inadequate.

NATURE ENCYCLOPEDIA

Edited by C. Clyde Fisher; five volumes bound in De Luxe Green Keratol lettered in Gilt, pages are 5 1/2 x 6 inches. Lives and habits of Birds, Mammals, Fish, Reptiles. Flowers and Trees: described by renowned Naturalists; 700 illustrations. 200 in Natural color. The Literary Mart, 8 East 33rd St., New York 16, offers this set for \$6.00, remittance with order, returnable for full refund within five days.

These creatures are among the most difficult to control in the garden. A remedy that works one time may not work the next—no one knows just what will work in all cases. An error that is grievous from the scientific point of view, though it may be passed off as not too important, is found in figure 102, in which the term "bee fly" is used to describe a beneficial *Syrphus*, or flower fly, larva. Bee fly larvae, while parasitic or predaceous on other insects, do not attack plant lice. The adults are very different from those shown in figure 106 (*Eristalis*), which are beneficial only because they pollinate flowers.

I prize the book as a most convenient reference, and hope that when war-time publication restrictions are relaxed it may be reprinted with more conspicuous headings.

C. H. CURRAN.

THE FUTURE POPULATION OF EUROPE AND THE SOVIET UNION — POPULATION PROJECTIONS 1940-1970

- - - - - by Frank W. Notestein,
Irene B. Taeuber, Dudley Kirk,
Ansley J. Coale, and Louise V. Kiser
Columbia University Press, \$3.50
270 pages, 55 line drawings

THE mere size of a national population and its relationship to land area are potent factors in the modern world. But population is a more complicated phenomenon than this. Its make-up in regard to age and sex also plays a subtle but determining part in shaping national policies. It is, therefore, more than an academic exercise to project the likely composition and size of Europe's future populations. Although such predictions are always premised on the continuation of certain primary conditions and are always progressively unreliable as we advance beyond the next generation, nevertheless a fairly accurate appraisal can be made for the 30 years ahead of us. This can be done because certain trends are inevitably fixed by our present status and cannot be altered except slowly.

The authors of this book have undertaken the gigantic computing job of such a projection and have emerged with results of vast importance to Europe's social and political planners. They indicate for western Europe a declining population, whereas for Russia the picture is one of rapid increase in the immediate future. But not only will western Europe be decreasing in size, it will also be losing a large part of its productive workers. This in turn may have repercussions on the use of women in industry and the attitude of women toward the home. The marked



BIRDS of the Southwest Pacific

by Ernst Mayr

The first book in English on the birds of this rich and remarkable area is the perfect Christmas gift for that boy in the Pacific. This practical handbook with keys tells how to identify and name the birds. Colored illustrations by F. L. Jaques. \$3.75

WILDWOOD WISDOM

by Ellsworth Jaeger

A veritable encyclopedia of woodlore for the experienced camper and the amateur, this book describes and illustrates with hundreds of detailed line drawings, the essential requirements for camping out. \$2.95

The American Rifle

For Hunting and Target Shooting

by C. E. Hagie

Here is a basic book on the rifle and its use, full of practical information without being too technical. Separate chapters are devoted to the various types of rifles and ammunitions. Illus. \$1.95



Compass of the World

Hans W. Weigert and Vilhjalmur Stefansson

Edited by a famous Arctic explorer and an eminent student of international relations, with articles by twenty-eight leading authorities and maps by Richard E. Harrison, this important new book offers a fresh perspective on our rapidly shrinking world. \$3.50

Arctic Manual

by Vilhjalmur Stefansson

Here is a broad, detailed view of living and working conditions in the Arctic. "Of immense value not only to the war effort but also to thousands of postwar sportsmen, explorers, traders, trappers, and armchair adventurers." *The New York Times*. \$3.00

THE MACMILLAN COMPANY
60 Fifth Ave., New York 11, N. Y.

aging of Western European population also creates a 'major social problem in the care of the superannuated, who in proportion to the workers will become more numerous.

The ramifications of such a changing composition in the social, economic, and political life of Europe are very extensive and beyond the scope of this review to trace. Their importance, however, is evident. Here is a fundamental analysis of far greater meaning to the world we face than the touted reportings of passing events.

H. L. S.

SPEED IN ANIMALS:

Their Specialization for Running and Leaping

----- by A. Brazier Howell
University of Chicago Press, \$4.00
270 pages, 55 line drawings

IN an introduction and summary covering the first four chapters, the author traces the general evolution of the vertebrates with special reference to their specialization for running and leaping; he follows the branching and sequences in fishes and amphibians, reptiles and birds, monotremes, marsupials, and placental mammals. The next four chapters deal with the muscular system, the axial skeleton, the arm, and the leg. Then comes a chapter on proportions, in which the percentage measurements of the upper, middle, and lower limb segments, in relation to the length of the limb as a whole, are critically analyzed on the basis of the author's own measurements on about 300 individual animals and of many additional measurements by other authors. Chapter X, like all other chapters, is packed with illuminating observations and analyses. It deals first with quadrupedal gaits, especially the trot, the pace, the walk, the slow and the fast running walk, the gallop, etc.; next with bipedal gaits, including the half-bound and the bipedal hop or "ricochet."

This work is one of the by-products of the author's many years of original research along numerous lines of vertebrate morphology, especially of the nervous and muscular anatomy of man and other vertebrates. In the present book his conclusions, listed near the end, number about 120, but many others are to be found throughout the text. The text figures and designs for chapter headings although few in number are beautifully drawn.

The author, a master of human and comparative anatomy, has a rather poor opinion of man's average ability as either a runner or a leaper. Except for length of limb, he writes, which has developed chiefly for the proper support of his entire body, man is "very poorly equipped for running, and it seems indicated that man did not develop his present form as a dweller of an open-plains habitat but as an inhabitant of a hilly country, in which there were frequent rocky spots for concealment and scattered trees that might be climbed at the approach of danger."

Speed in Animals is bound to be studied frequently by students of the evolution of the vertebrates, by mammalogists, anthropologists, ecologists, students of animal behavior, and by all those who are

interested in the speed of horses, dogs, cheetahs, elephants, deer, antelopes, giraffes, and many other animals.

W. K. G.

JOHN MERLE COULTER:

Missionary in Science

-- by Andrew Denny Rodgers III

Princeton University Press, 1944, \$3.75,
321 pages

THIS book is not only the story of the life of one of America's greatest botanists, but it is at the same time a scholarly history of American botany during the late nineteenth and early twentieth centuries, with emphasis upon Coulter's contribution to the development of this field of science.

Mr. Rodgers has given us a biography of William Sullivan, pioneer student of mosses, and one of John Torrey, who has been called "The Father of American Botany." With the publication of the present volume on John Merle Coulter, we learn that the author has in preparation a fourth volume devoted to the *Decades of Transition of American Botany, 1873-1892*. This book taken together with the one on John Torrey will complete the story of the work of Asa Gray.

The preparation of these volumes has entailed a vast amount of research, in which we are told that the author has examined no less than 4500 unpublished letters and much valuable manuscript material. The information gathered here, together with Mr. Rodgers' thorough familiarity with the botanical literature, makes his books the bible of the history of American botany down to the present time. They will be extremely valuable in college and university courses in the history of botany.

Coulter was more than a botanist,—he was first a man of forceful character and of broad vision. His life is traced from his days as teacher of botany in Hanover and Wabash Colleges in Indiana, as President of Indiana University and of Lake Forest College, as head of the Department of Botany at the University of Chicago, and finally as chief advisor in the establishment of the Boyce Thompson Institute for Plant Research. He was an indefatigable worker and his contributions were immense. Probably his colleagues would have considered his *Morphology of the Gymnosperms* (with Chamberlain as co-author) as his most scholarly work. Not only was he a profound research student, but he was pre-eminent as an interpreter and teacher of botany. His many students

WALKER PRIZES IN NATURAL HISTORY

For the two most acceptable essays on Mammals, the Boston Society of Natural History is offering two prizes of \$60.00 and \$50.00 respectively under the foundation established by the late Dr. William Johnson Walker. The competition for these prizes is not in any way restricted. Persons interested are invited to obtain a copy of the rules from Miss Margaret Baker, Boston Society of Natural History, 234 Berkeley Street, Boston, Massachusetts.

may be most grateful for *A Text Book of Botany* by Coulter, Barnes, and Cowles.

CLYDE FISHER.

THE NAVAHO DOOR, AN INTRODUCTION TO NAVAHO LIFE

- - by Lt. Alexander H. Leighton,
U.S.N.R.
and Dorothea C. Leighton, M.D.

Harvard Press, \$4.00
149 pages, 28 illustrations

THIS is a different book from the usual accounts of the picturesque aspects of Indian life. It is a close up, plain speaking comment upon the most important but homely family activities which we designate as general welfare and public health, written by two medical practitioners after living among the Navaho for a time. The case for the Navaho is presented skillfully and concretely in terms of daily family situations. The Navaho live in a harsh environment, where rainfall is so scant that the necessary crop of corn and beans stand little more than an even chance of survival. There are now too many Navaho for their tribal lands; sheep, their main dependence, are too numerous for their acreage, and so overgrazing is leading to land waste by erosion. They are caught in a vicious circle. Their young men have gone to war, making life still harder for the older men, women, and children. The average income is about \$82.00 a year, of which \$7.00 is from the sale of woven rugs, the labor return for which is less than five cents an hour.

The reader is given an insight into the function of Navaho religion, the chief concern of which is with the physiological and mental health of the population. About 20% of the family income is spent in ceremonies to heal the sick. White doctors and hospitals are available for emergency cases, but the war has greatly reduced even this inadequate service. Among the many side-lights upon Navaho home life are a few brief typical autobiographies.

Finally, we learn that the future of the Navaho is by no means assured. Local white people want their lands, want them eliminated, want their standards of living still further reduced to afford pauper labor, etc. It is the old story of a minority race whose room is wanted instead of its presence. The closing scene of the narrative is with a Navaho family awaiting a visitor who can interpret to them a Government letter which "deeply regrets to inform you that your son. . . ." C. W.

LEARN AT HOME TO MOUNT BIRDS



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ANCIENT MAN IN NORTH AMERICA

----- by H. M. Wormington
Colorado Museum of Natural History,
35 cents, 89 pages, 14 illustrations

THIS is a welcome addition to museum handbook literature. It is appropriate that the Colorado Museum of Natural History should issue such a handbook because the initial discovery of the so-called Folsom Culture was made by the director of that institution, the first satisfactory evidence of association between New World man and extinct fauna. Random suspicious finds had been made before but never under conditions eliminating every possible doubt. The text presents in order of discovery some 27 important sites in the United States and Canada, giving concise enumerations for the findings in each, information as to the artifacts, the extinct species represented, and a statement of the significance of the same. As far as observed the information given is accurate and sufficiently comprehensive. As a handbook for advanced students and the specialist it will furnish a ready source for the verification of the pertinent facts. The illustrations are chiefly the type artifacts, as Folsom, Yuma, and their various subtypes. A comprehensive bibliography is furnished and a glossary of terms for the general reader. We highly recommend this booklet for your reference shelf.

C. W.

SMOKY RIDGE

by
FREDRIC DOYLE

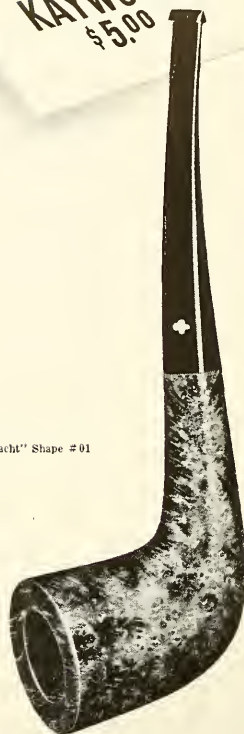
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LETTERS

Continued from page 340

that the left pair of wings has also a slight revert to female coloring in one spot on the hind wing, as the specimen is perfect and this change in coloring does not represent a tear or abrasion of the wing. I felt particularly fortunate in being at the right spot at the right time to take this extremely rare freak of Nature and hope that *NATURAL HISTORY* readers will get the thrill that I did out of seeing it.

HARRY L. JOHNSON.

South Meriden, Conn.

SIRS:

... My copies of *NATURAL HISTORY* really saw more active service than any other magazine received in the area. They were read and passed from one to another until only fragments were left. To some of us it was an old friend, to others a new one, but each one of us found articles and comments on subjects we were very much interested in.

I wish to take this opportunity to thank

you for getting each copy of *NATURAL HISTORY* out to me.

Lt. (j.g.) M. LAVERNE HALES,
U. S. Naval Hospital,
Jacksonville, Florida

SIRS:

... I congratulate you on producing so interesting and beautifully gotten up a magazine.

FREDERICK DWIGHT.

Red Bank, N. J.

SIRS:

I would appreciate it very much if you would tell me whether crocodiles shed real tears.

CHRISTINE SERAYDARIAN,
Greenwich, Conn.

I have never seen crocodile tears, but I have seen alligator tears. While feeding a five-foot Florida alligator some years ago, I gave it an overlarge piece of raw meat. The alligator can do little in the way of tearing its food into smaller pieces, and while this one

was straining to swallow the meat, a number of huge tears ran from his eyes and down over his "cheeks," if his jugal region might be so called. They were veritable "crocodile tears." The alligator has a tear (lachrymal) gland in the corner of each eye.

A. M. REESE,

Professor of Zoology.

West Virginia University,
Morgantown, W. Va.

SIRS:

... Your Magazine is read from cover to cover with a great deal of profit and enjoyment. I am particularly interested in anthropological material and ornithology.

FREDERICK G. TINLEY.

Trumann, Arkansas

SIRS:

... *NATURAL HISTORY* Magazine cannot be surpassed by any other; it is really a wonderfully interesting and educational magazine, and its pictures are outstanding. Keep up the good work.

Detroit, Michigan.

LEO F. BAGOUX.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at \$1.00 each, with full credit to the photographer. Return postage must be included.

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AUSTRALIA—THE STORY OF A CONTINENT

Continued from page 374

colonists, the intrepidity of the explorers who pushed farther and farther into the "Never-never Land." Perhaps less spectacular but of even greater importance is the enterprise and persistence of the sheep owners, who hung on through drought and flood and all sorts of disasters, gradually winning the fight against the myriads of rabbits and many other plagues that were introduced through ignorance and carelessness. Then came the discovery of gold, the rush into desert places, the booms and the collapses and revivals of the search for metals. Meanwhile the very magnitude of the obstacles encouraged large-scale organizations and wholesale methods of exploiting the fabulous wealth of the coal fields, the iron, and the silver, and the gold.

Homo sapiens, the most destructive species of all time, was turned loose to hack down and clear away the noble Australian forests. And as if droughts and floods on a huge scale were not enough, forest fires again and again left thousands of square miles a mass of smoking cinders.

But something in the elemental forces that produced these disasters helped also to develop the typical Australian of the present day—a man who can "take it," building a nation that is winning a new and well reasoned way of more abundant life.



November **NATURAL HISTORY** 1944

Beavers: Edwin Way Teale • Camel Brigade • Whitetails

Ol' King Coal • Stingless Bees • Rare Goose • Turtle

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SIRS:

The accompanying photograph shows a somewhat rare natural occurrence, "white shadows" cast by trees. The explanation of this unusual event is as follows:

On April 3 at 4:24 P.M. a light dusting of snow covered the ground. Then the sun came out hot for only a few minutes, melting the snow everywhere except in the dark shadows. The sun went under clouds until night, leaving the white "shadows" clearly marked.

The photograph was taken early the following morning before the sun had come out and destroyed the marks.

R. PHILIP HART.

Cazenovia, New York

SIRS:

I wish to comment with unrestrained admiration on the thoughts expressed by Mr. A. E. Parr in his recent editorials in your magazine. Few have thought more clearly and objectively in speaking of Science's most worthy aims.

At the same time may I also suggest that the article "Origin of the American Indian" by Dr. Clark Wissler seems to express a degree of pessimism toward race tolerance that many do not share. I refer to the statements: "How came this splitting up of the world among three varieties of modern men? Must one recognize an ancient deep-seated hostility to distinctions in appearance, skin-color, hair-form, etc.? And if there has been such a remote and long-continued reaction of this kind, is it reasonable to expect that the struggle for complete race tolerance will be a mere 'picnic excursion'? Can wishful thinking assure such an easy solution?"

The author is certainly entitled to his judgment. But my own reaction is that enough progress is being made toward race tolerance (much of it by leaders in the science of anthropology) to encourage optimism, and that most persons are sufficiently aware of the difficulties of achieving complete race tolerance not to need cautioning against over-optimism.

A. J. LEVIN.

Detroit, Michigan

DEAR DR. GUDGER:

"Two Fishing Cats That Made History" is a delightful article. Since you are interested in fishing felines, perhaps there is a story behind the name of a little alley in Madrid, in the oldest section of the city, close to the Puerto del Sol, named Calle del Gato [Street of the Cat]. Although it is wide enough for a motor



▲ "WHITE SHADOWS" cast by trees: an unusual natural phenomenon that is explained in the accompanying letter from Mr. R. Philip Hart, who took the photograph

vehicle to pass, there is a metal post at either end of this short passage so that only pedestrians can use it. . . .

Thanks for your article, and I hope your researches continue to turn up such charming information about the past.

New York, N. Y. FREDERICKA MARTIN.

SIRS:

Please send me four copies of the reprint of "Peoples of the Pacific." A check is enclosed.*

May I take this opportunity of saying how heartily I agree with Dr. Parr's point of view in his editorial in the September issue of NATURAL HISTORY? He is giving fine leadership.

Mrs. BRADFORD YOUNG.

Manchester, N. H.

SIRS:

Have enjoyed every page and line of your magazine. It just cannot come soon enough, and my son can hardly wait for me to finish before he takes possession. He says he will keep them for me with

* Reprints of this article, popular among service men in the Pacific area, are available at 25¢ each plus 3¢ for mailing.—Ed.

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his prize books—and that is the last I see of them until I get the next one . . .

(Mrs.) B. W. LAWLOR.

Richmond, Staten Island, New York

SIRS:

Your publication contains a wealth of varied and interesting information. Most of us have only limited opportunity to travel and become acquainted with the studies of archaeology, anthropology, etc., but with NATURAL HISTORY Magazine the reader is aided in realizing and appreciating the significance of these fields. I am looking forward to the time after the war when we shall be able to visit the Museum and when the younger ones will be old enough to read the Junior publication. . . .

RICHARD L. SHROAT.

Baltimore, Maryland

† JUNIOR NATURAL HISTORY, published monthly by the American Museum of Natural History, has a subscription rate of \$1.25 a year.

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ALBERT E. PARR, Director

VOLUME LIII—No. 9

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NOVEMBER, 1944

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YOUR NEW BOOKS

NAVAJO SILVERSMITHS • PACIFIC BIRDS • ENTOMOLOGY
AMERICAN BOTANY • WOODS HOLE

BIRDS OF THE CENTRAL PACIFIC OCEAN

— by Thomas M. Blackman

Tongg Publishing Co., Honolulu, \$3.00
70 pages, 18 illustrative plates

HERE is a book, stimulated by the war, designed to give men in the Armed Services a means of identifying the sea birds and shore birds that they are likely to encounter in the course of their voyages. The forms of birds covered are the albatrosses, petrels, boobies, frigate-birds, tropic-birds, terns, and the snipes, plovers, and phalaropes. The text is supplemented by 18 plates: one is a simple and practical map, six are in color from the author's drawings, and the rest are from his photographs, either in color or in black-and-white.

The work is no mere compilation, for the author has made many field observations, both in the long chain of islands that stretch toward the northwest from Hawaii and also in the Midway group, which, until the beginning of the war, was a station on the trans-Pacific airlines. Many of the observations are original and of considerable biological interest. So far as the reviewer is aware, we have here the first convincing evidence as to the existence of hybrids between two species of North Pacific albatrosses.

The color plates are somewhat "hard" and are to be regarded as practical, rather than artistic. Nevertheless, the details of posture and plumage, particularly as represented by the albatrosses, frigate-birds, and boobies, display an accuracy that is all too often lacking in illustrations that have a stronger appeal to the esthetic sense. The photographs not only illustrate the text but also highlight many interesting aspects of bird behavior. Particularly impressive is one showing a fairy tern carrying at least a dozen small fishes crosswise along the length of its bill, raising again the old question, as yet unanswered, as to how the bird makes the latest capture without losing all that went before!

A few usages of technical names indicate that the author has not made himself wholly familiar with the recent literature within his field. This had led him, for example, to include two distinct subspecies of one petrel as breeding birds in the Fiji Archipelago, a situation that is commonly regarded as a biological impossibility. Furthermore, in his references to literature on the area, he might well have consulted and listed E. H. Stickney's records of North American shore birds among the Pacific Islands. Such comments,

however, do not imply any serious failing in an admirable and timely little book that is likely to be useful for many years to come.

R. C. M.

BRIDE IN THE SOLOMONS

— by Osa Johnson

Houghton Mifflin Co., \$3.00
251 pages, 66 illustrations

IN her latest book, Osa Johnson returns to the beginning of her career of adventure. Newly married, she and her husband, Martin Johnson, set out for the Solomon Islands where they hoped to take photographs of actual cannibalistic rites. Her account of their experiences during this quest constitutes the subject of *Bride in the Solomons*. The Johnsons cruised in trading schooners, visited plantations, and made repeated visits into the jungles beyond the beaches. Everywhere they took pictures of natives and enjoyed or endured what nature provided. Not until the end of the book, quite properly, do they run into the cannibals they were seeking—and then not in the Solomons but in the neighboring New Hebrides.

Mrs. Johnson seems to have a lively sensory equipment, so that *Bride in the Solomons* is full of the sounds, colors, and smells of these islands. Observations on birds, plants, fishes, and natives are abundant and usually entertaining. We may gather from her descriptions vivid impressions of what our men must have experienced during the Solomons campaign.

H. L. S.

THEY HOP AND CRAWL

— by Percy A. Morris

The Jacques Cattell Press, \$3.50
253 pages, 115 illustrations

ACCORDING to the statement on the cover, this book is "one of the humanizing science series." The author calls it "an attempt" to present descriptions of the amphibians and reptiles of the United

States and "all the things that, taken collectively, go to make up their habits of life."

In this attempt, the author fails miserably. There are few pages on which at least some erroneous statement does not occur, and misleading statements abound throughout the book. Any herpetologist knows how difficult it is to make sound generalizations concerning reptiles or amphibians. But Mr. Morris rushes right in where better biologists fear to tread. The statement is made that the alligator lizards (*Gerrhonotus*) "do not lay eggs," although, so far as is known, only one species in the United States is ovoviviparous. Also, contrary to Morris' statement, many horned toads lay eggs.

When a fang is shed, a replacement is not "ready to swing into position" the new fang is already firmly anchored in the socket adjacent to that of the fang that has dropped out. The rear-fanged snakes do not have their venom-conducting teeth grooved "along the back edge." And by no means 70% of the snake bites occurring in the United States are "the result of handling captive snakes"; published figures indicate that no more than approximately 4% can be attributed to this. These are merely examples.

The photographs are good, bad, and indifferent, with the majority of them falling into the latter category. Few naturalists will be fooled by the photograph of the horned toad in which a badly over-stuffed specimen of the sort sold to tourists is depicted. The Gila monster shown is a faded stuffed specimen, and the reptiles captioned "Pine Snake" and "Western Diamond-back Rattlesnake" are wrongly identified.

Doubtless there is a real demand for "humanized science." But when so much error creeps, hops, or crawls into one book, it ceases to be science.

C. M. BOGERT.

THE NAVAJO AND PUEBLO SILVERSMITHS

— by John Adair

University of Oklahoma Press, \$4.00
220 pages

THIS book is number twenty-five in the excellent Civilization of the American Indian Series published by the University of Oklahoma Press. The author is a trained ethnologist, formerly manager of the Navajo Arts and Crafts Guild, and now serving in the United States Army Air Forces.

Among the primitive native American

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Edited by G. Clyde Fisher; five volumes bound in De Luxe Green Keratol lettered in Gilt, pages are 5½ x 6 inches. Lives and habits of Birds, Mammals, Fish, Reptiles, Flowers and Trees; described by renowned Naturalists; 700 illustrations, 200 in Natural color. The Literary Mart, 8 East 33rd St., New York 16, offers this set for \$6.00, remittance with order, returnable for full refund within five days.

handicrafts (silversmithing, pottery-making, rug-weaving, basket-making, bead-work, and the like) probably nothing is more widely admired than Navajo and Pueblo silver work. In preparing this book, the author has made a careful examination of the principal museum collections of the country and has spent a great deal of time in intensive study of the present status of the craft on the Navajo Reservation and at the various pueblos.

The Navajo acquired the art of silver-making from the Mexican *pateros* (silver-smiths) who lived in villages in the upper Rio Grande Valley and at the southeastern edge of the present Navajo Reservation. This was some time between 1850 and 1870. The Zuni learned the art of silversmithing from the Navajo, and the author spent many hours talking to the first Zuni to learn the craft—an old man named Lanyade about 95 years of age at the time of the interview. He had been taught silver-making by a Navajo in 1872, when he was about 30 years old.

Mr. Adair visited many of the smiths on the Navajo Reservation and at the various pueblos, watched them work, questioned them, and was himself taught how to make silver jewelry by one of the best Navajo craftsmen. As a result of his thorough-going researches, he has given us a most complete and dependable history of silversmithing, in all its cultural relations, among these Indians of the Southwest. The book is copiously illustrated with well-chosen photographs. The foreword was written by Dr. Clyde Kluckhohn of Harvard University. The author also acknowledges the co-operation of a number of leading American anthropologists, several of whom read the manuscript critically before publication.

TE ATA AND CLYDE FISHER.

I WENT TO THE SOVIET ARCTIC

----- by Ruth Gruber

Revised edition. Preface by Vilhjalmur Stefansson

The Viking Press, \$3.50

285 pages, 16 illustrations

MISS GRUBER'S book is an enthusiastic account of a trip to Siberia as a newspaper correspondent in 1936. She flew to Igarka, where she apparently spent a few weeks (dates and lapses of time are left obscure), and thence sailed to Murmansk by way of the Arctic Ocean, with a briefer stop at the Soviet scientific station on Dickson Island at the mouth of the Yenisei. On the basis of this limited but significant experience, she has produced an excellent popular account of the romantic and important advance of Soviet colonization and science into Arctic Asia.

The best of the book is Miss Gruber's detailed description of what she saw and of the people with whom she talked in Igarka, a bustling pioneer town within the Arctic Circle. Here the Russians are demonstrating that the Arctic is habitable and that the riches of Siberia can be exported along the great northward-flowing

Continued on page 427

BOOKS

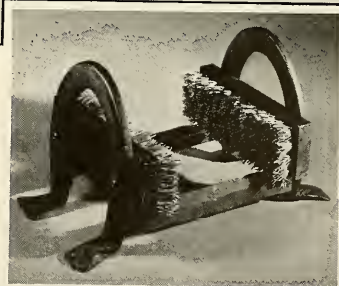
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▼ THE BEAVERS come up and climb into Mrs. Richards' lap, sitting on an oilcloth which she wraps around her legs as protection from the dripping water. They sit up like huge chipmunks while eating the quartered apples



BEAVER

By EDWIN WAY TEALE*

All photographs by the author

FOR more than 700 nights, Dorothy Richards has spent her evenings sitting on the bank of a beaver pond. During the past three years, she hasn't missed an evening from the time the ice breaks up in March until it closes in again in December. Sometimes it's so cold she has to bundle up in four sweaters, three pairs of wool socks, aviator's mittens, two wool bonnets, and a wool scarf; sometimes the summer mosquitoes are so bad she has to coat her face with oil of tar and citronella;

sometimes the driving rains find her clad in a West Point raincoat which belonged to a six-foot-four-inch nephew and which encloses her five-foot-six-inch form like a rubberized cocoon.

With infinite patience, during those 700 nights, she has made friends with the beaver colony. They come when she calls. They eat out of her hand. They sit on her lap. Something in the manner of an Indian tribe taking in a distinguished white visitor as an honorary chief, the beavers have made

her one of themselves. She knows them as individuals, as Samson and Delilah, Forty-One and Pook, Junior and Ella, Bessie and Imp. To the uninitiated, beavers may appear dead-pan and dull. To Dorothy Richards, who probably has spent more hours than any other living person watching these aquatic engineers when they are acting naturally and without restraint, they are the most appealing and human of wild creatures.

One summer, after the colony had learned to come up on the bank and

eat apples from her hand, three-months-old Pook found himself on the outside of the crowd looking in. He pushed and shoved like a late-comer at a bargain-counter. Then he waddled down the bank and, slipping silently into the water, slapped the surface with a resounding whack. At this alarm signal, all the other beavers plunged into the pond headlong. Pook hurried to shore and by the time the others returned he was first in line at the apple-basket.

During the next two weeks, he repeated this stratagem four or five times. Then he never did it again. Perhaps, the elders of the colony had taken him into a beaver equivalent of the woodshed. At least, he seemed to have been properly impressed with the enormity of his wolf-crying offense.

As a rule, beavers are the gentlest of creatures. In taking apples or corn from Mrs. Richards' hand, their great chisel-teeth never touch her fingers. Sometimes in picking up dropped bits of apple, they accidentally nip small holes in the oilcloth she wraps around her legs. Then, when the next arrival clambors dripping from the pond and climbs into her lap, little streams of water pour through the openings. The turnover in oilcloths is fairly rapid. One, which she left lying on the pond bank over night, disappeared before morning. The beavers had taken it into the lodge to use for bedding.

On another occasion, the six-foot, flat-bottomed blue boat in which she sometimes paddles about the pond,

disappeared from its moorings. The beavers had sliced off the rope and hauled the 75-pound boat up on the lodge, adding it to the sticks and other material with which they were re-enforcing the house for winter. Since then, the boat has been anchored with a metal chain. The young bloods of the colony never seem to tire of coming up under the boat and boosting it rhythmically with their backs while the steel chain gives off a steady "Clank! Clank! Clank!"

Beavers avoid touching metal with their teeth, also stones apparently. During one rainy spell, shelled corn—ordinarily dumped in little piles on the ground—was placed on a flat piece of shale, about fifteen inches square, to keep it out of the mud. Delilah viewed this arrangement with evident disapproval. Finally, she picked up the rock in her forepaws, dumped the corn off into the mud, and tossed the stone aside.

The idea that beavers are voiceless and silent is miles from the truth. All through the night, when they are undisturbed and not being observed by strangers, they keep up an almost constant calling and conversation. Some of their sounds suggest the whimpering of a puppy, others the crying of a human baby, still others the nasal "yaank!" of a nuthatch. There is a windy hiss and a complaining squawk, and a faint, faraway hornlike tone which seems to be the most common sound in ordinary conversation. The animals seem to hear higher tones better than lower ones. In calling: "All right! Come on! All right!" Dorothy Richards always uses a high-pitched tone of voice. The young beavers all have higher voices than the older ones.

In an autumn dusk, when white mist is curling up from the black waters of the pond, the beavers produce an odd assortment of sounds as they begin to feed. A beaver consuming leaves and twigs of poplar sounds like a rapidly-run sewing machine.

One eating dry bread suggests the rapid quacking of a wild duck. Another, busy stripping bark from a poplar stick, sounds as though he were at work rasping with a large file.

All of these sounds are familiar both to the beavers and to the silent watcher on the bank. Each noise tells its story. Any new sound is noticed instinctively. On rainy and windy nights, the beavers are invariably nervous and jumpy; on calm nights, when they can hear perfectly, they are most relaxed and at ease. A certain alarm cry of the flickers, which dart among the dead trees of the beaver bog at sunset, puts the nerves of the animals on edge. At such times, they disappear in a flash at the first abnormal occurrence. Once, just as a young beaver poked its head above the surface of the pond, a dragonfly alighted on the tip of its nose. The youngster dove in alarm, and all the other beavers of the colony disappeared in a sudden panic.

Besides apples and corn and dried whole-wheat bread, the beavers in the Richards' colony have a particular liking for the leaves of wild raspberries and wild evening primrose. Sometimes, Mrs. Richards spends half an hour on a summer's afternoon picking a basketful of red clover blossoms. These form a special delicacy for the beavers. Among the trees and bushes of the region, they show a preference for poplar, willow, osier, alder, dogwood, wild cherry, maple, elm, and yellow birch. So far, they have turned up their noses at such foreign fare as carrots, peas, and potatoes.

Different beavers have individual preferences in the matter of foods. One tackles dry bread with gusto; another tosses it aside in favor of shelled corn, which a third ignores completely. In consuming her share of shelled corn, Forty-One always follows the same unique procedure. She steadily picks up the kernels with her right paw while she holds her left paw under her chin to catch any that

SHOW

Few persons have ever seen beavers do the "bunnyhug" or play tricks on each other, but these are only a few of the rewards that come from spending seven hundred nights in intimate association with wild beavers

*EDWIN WAY TEALE is the author of eight books, mostly on natural history subjects. One of them, *Grassroot Jungles*, has been translated into Braille by the Library of Congress. Another, *Near Horizons*, won the John Burroughs Medal. Mr. Teale's early career was in the publishing field and as a teacher of journalism and English. For eight years he has maintained an "insect garden" on Long Island, in order to study insects in an outdoor

laboratory. He has taken more than 15,000 insect and nature photographs, hundreds of which have appeared in textbooks, magazines, and scientific papers, and been exhibited in photographic salons. He has contributed features and articles to more than 50 publications here and abroad. He is the President of the New York Entomological Society and belongs to numerous other scientific associations.

—ED.

drop from her mouth. Chewing away, her eyes closed, she is a picture of perfect contentment.

In the course of a year, Mrs. Richards feeds her wild friends some 300 pounds of corn and upwards of 25 bushels of apples. Last season, when the price of apples climbed to \$4.70 a bushel, the Richards didn't dare eat any of the fruit themselves. They saved it all for the beavers. Frequently, Mrs. Richards eats her supper on the bank of the pond. The beavers sniff at her bottle of milk but they never touch the stuff. In eating apples, they stand up on their hind legs and hold the fruit in their forepaws like a chipmunk. The apples are cut into quarters. If one gets a whole apple, it always goes off in the water by itself to eat the prize. And, whenever a beaver has a chance to pick an apple from the basket, it invariably paws the fruit over carefully and selects the biggest one.

It was through apples that Dorothy Richards first made friends with the colony. Her interest in these animals began about eight years ago when she read *Pilgrims of the Wild*, by Grey Owl, the Indian-naturalist who maintained a beaver sanctuary in Canada. About this time, she moved from Little Falls, N. Y., where her husband, Al Richards, runs an office-supply business, to an abandoned farm some miles from Dolgeville, on the southern skirts of the Adirondacks. They named their dilapidated country house "London Bridge"—it was falling down.

Since then, they have repaired the dwelling, installed modern conveniences, and increased their holdings to 316 acres. Included in this area is a section of the wandering Little Sprite Creek. In this watercourse, in 1935, they released a pair of beavers supplied by the State. They named them Samson and Delilah. After they were well established, Dorothy Richards began taking apples to the pond bank, gradually winning their confidence.

One dark Saturday afternoon in March, two years later, she and her husband followed the path over a towering hill for a quarter of a mile to the beaver lodge. They found a gaping hole kicked in its side. Near the entrance, Delilah's head popped to the surface for an instant and then was dragged down again. It appeared once more and was pulled under the water almost instantly. An illegal trap, with its teeth sunk in a forepaw, had been wired to a great watersoaked

log. For how many hours no one knows, the beaver had been pulling with all her strength to lift the log from the pond bottom, had been struggling to the surface, had been gulping in air and then had been dragged swiftly under again. She was near the end of her strength when Al waded into the icy water and released her. He carried her home and they installed her in an upstairs bedroom for the night. She lay on the floor as though dead. But with the passing of a few hours she revived and began prowling about the room. A little after midnight, they heard a crash. Delilah had gnawed a leg off a spinet desk.

Some days later, when they released the beaver on the edge of the pond, she swam away upstream accompanied by Samson. The pair disappeared, and for three years there were no beavers on the Little Sprite. During those years, Dorothy Richards went through a serious illness and a major operation. After fourteen months in the hospital, she was convalescing at home when, in the spring of 1941, Al discovered that the beavers had returned. That very day, Dorothy climbed the hillside trail and visited the new pond. The beavers provided an absorbing interest, a new lease on life, a road to recovery. Curiously enough, although she sits for hours in wind, in rain, in the lowland mist, she has never caught a cold at the beaver dam.

Each autumn, the Richards rent a team and lumber wagon and haul loads of poplar to the banks of the Little Sprite. The beavers cut it into short lengths and anchor it in piles to provide food during the winter. Helping in this work is one of the first jobs of the young beavers.

One September evening, Dorothy saw a baby beaver swimming through the water, towing a stick hardly larger than a twig. At the pile, it twisted and shoved, trying to anchor it in place. When it had succeeded, it climbed to the top of the pile, pulled out a stick ten times as big as the one it had added to the food supply, and ate off the bark.

While the beavers welcome the loads of poplar, that is about all the help they will accept. If sticks are added to the dam or lodge, they throw them away. If the same sticks are left floating in the water, they will use them in the same dam or lodge themselves. Three times, Al Richards put up large "No Trespassing" signs, and each time the beavers gnawed off the sup-

porting poles and used the signs for strengthening the dam. Now a post of metal supports the signboard. Various odds and ends, including old tin cans, are used in the mud walls of the lodge.

It is during those early-autumn nights when new mud is being applied that the patience of the older beavers is stretched to the breaking point. The youngsters, consumed by curiosity, keep getting underfoot. Worse than that, when the old beavers are struggling up the steep sides of the lodge, walking on their hind legs and carrying great loads of mud clutched in their forepaws, the baby animals follow close behind and step on their flat tails.

Each litter has one beaver that is more friendly and interesting than the others. Pook stands out in Mrs. Richards' memory among all the small fry of the beaver pond. It was he who slapped his tail in deceitful warning to get his share of apples—and a little more. When he was playing, and appeared to be tickled at something that happened, he would throw himself over backwards on the grass of the pond-side. One evening, when his mother was busy eating corn, he crept up silently behind her, stood on his hind legs and, with his forepaws outstretched, gave a sudden forward leap. The unexpected shove threw his mother off her balance, and in an ecstasy of glee Pook threw himself over backwards so hard he rolled off the bank into the water.

A game which the young beavers play endlessly in the shallows resembles the old-fashioned dance, the Bunnyhug. Two will stand up, put their arms around each other and, cheek to cheek, will twist and sway. The game seems to be to throw the other beaver off balance. As soon as one loses his footing, the wrestlers part and the fun begins all over again.

To an outsider, the young beavers of a litter all look alike. But Dorothy Richards can tell them apart: one has redder fur, another has a huskier voice, a third has individual preferences in food. Knowing her beavers intimately and seeing them under natural conditions, she is making observations of intense interest to scientists. There are many riddles still to be solved in connection with the life of the beaver. Dorothy Richards' pond-side watching promises to play an important role in solving them.

Samson has already provided the answer to one problem. There has been considerable difference of opinion



◀ MR. AND MRS. A. M. RICHARDS carrying poplar branches, apples, corn, and other food to the pond of the wild beaver pets. In autumn, they hire a team and wagon to haul loads of poplar which the beavers add to their winter food-supply



▲ SOME OF THE FOODS relished by the beavers: corn, apples, dry whole-wheat bread, dogwood, willow, wild cherry, raspberry leaves, poplar, and alder



➤ ON THE BANK of the beaver pond, Dorothy Richards often eats her supper while waiting for the animals to appear at sunset



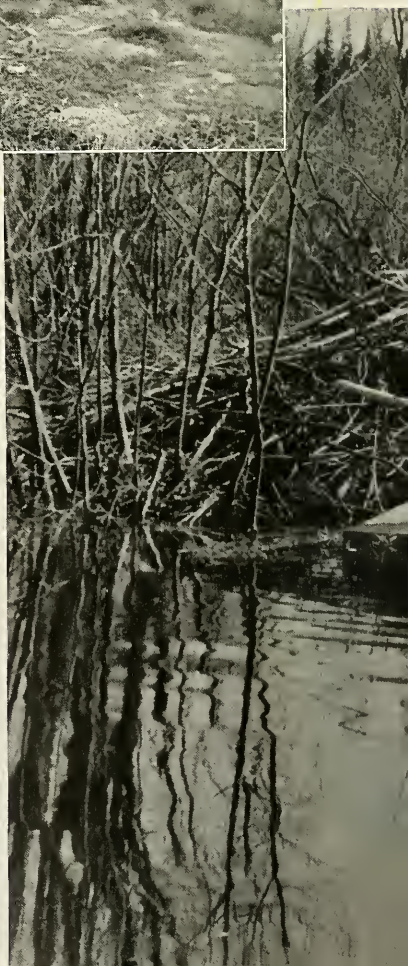
▲ ANOTHER shot of Mrs. Richards feeding the beavers. Samson, the male, weighs about 50 pounds, Delilah, his mate, nearly 60. The young beavers weigh about 10 pounds at the end of their first summer

among experts as to whether a male beaver takes more than one mate. Two years ago, when Forty-One, a young female, came swimming down the Little Sprite and joined the colony, she was accepted without reservations by Delilah and became the second mate of Samson. This two-lodge arrangement has worked without friction. Delilah has been seen carrying poplar leaves to Forty-One's babies and Forty-One has been seen carrying one of Delilah's babies in her arms to the safety of a lodge when she thought danger threatened.

Whenever a stranger accompanies Mrs. Richards to the pond, all the beavers swim about waiting for Delilah to size up the situation. She is the real leader of the colony; the others rely on her judgment. When she decides it is safe to climb the bank, they all follow suit. The year her first litter of kits arrived, she kept them away from the bank until mid-summer.

Then, one evening, after she had eaten, she sat up in Mrs. Richards' lap and looked her in the face for more than a minute as though thinking deeply. Then she swam directly to the lodge and returned with the baby beavers swimming after her. The youngsters, after that, came nightly to the bank for their share of the free lunch.

It was when these babies were so small that they had not yet learned to swim that Delilah demonstrated how, in her gentle way, she managed Samson. Each night, he came down to the poplar pile and took back twigs and leaves to the lodge. One evening, he nibbled a leaf himself, then another, then a twig, and soon he forgot all about his duties and gave himself up to the pleasures of feeding. A quarter of an hour went by. Then Delilah came swimming through the dusk calling: "Oooooo! Oooooo!" Samson went to meet her. She began frolick-



➤ THE BEAVERS once pulled this 75-pound boat up on the side of their lodge when preparing the house for winter. They also "borrowed" one of the large pieces of oilcloth for bedding in the lodge

▼ THIS "NO TRESPASSING" sign, which calls attention to the fact that the beavers are pets, had to be replaced three times. The animals gnawed off the supporting poles and put the sign to work strengthening the dam. Now the signboard is supported by a metal pole



ing with him, diving under him and boosting him up, climbing on his back and submerging him, all the while working him in the direction of the lodge and the beaver kits. When she had him close to the entrance, she swam swiftly back to the poplar pile. Samson took the hint and went inside to mind the babies.

Although it is only a few hundred rods over the hill from the farmhouse to the beaver pond, Dorothy Richards has covered more than 500 miles walking along the trail. Usually she starts the evening's adventure around five in the afternoon. The temperature, at that hour, has ranged from 90 degrees, in August, to 26 degrees, in early December. On the latter evening, little icicles formed on the fur of the beavers as they sat in her lap and ate apples.

When a family birthday party once kept her in Little Falls until almost midnight, Mrs. Richards felt her way along the trail to the beaver pond as soon as she reached home. At her call: "All Right! Come On! All Right!" the beavers came swimming out of the dark to greet her.

Her first 700 nights of beaver-watching have just whetted her appetite for more. The pond has provided her with a show of perpetual interest—a show that appears destined to make the run of *Abie's Irish Rose* or *Life with Father* seem no more than a one-night stand.

THE CAMEL BRIGADE

Some of them escaped to surprise an occasional traveler in our Southwestern deserts years later, but otherwise few people are familiar with this dramatic chapter in the history of our west

By HOBART E. STOCKING*

WHEN Lewis and Clark were preparing for the expedition that officially opened the West, President Jefferson instructed them to be on the lookout for the remains of prehistoric monsters. In this request he showed a scientific interest well ahead of his time and a realization of the potentialities of an unknown land.

Popular belief had it that in a region as vast as that which lay beyond the Mississippi there was space for anything and everything. The West held no surviving mammoths but it has produced other wonders no less magnificent or unusual. Easterners have long been accustomed to the marvels of the West, with its "greatest plains," "highest mountains," "widest deserts," and "deepest valleys." Many are inclined to believe that if, through oversight or circumstance, something might be lacking among the wonders of the West, it would soon be supplied by some accommodating person—if not produced in body then distilled from fancy.

An Easterner who chanced to read

in the 1907 issue of the *Rhyolite* (Nevada) *Journal* an account of a prospector who had seen two life-size camels in the desert, probably attributed the item to the obliging hospitality of the Westerners. Someone evidently had felt that the West should have a few camels; a prospector conveniently "saw" two, and the *Journal* dutifully reported the incident as a feature of a country that had everything.

It is probable that the younger subscribers of the *Journal* were equally skeptical, for if they knew nothing of camels, they were at least familiar with the visions of prospectors. But their elders, whose memories were longer, were more credulous. They reckoned that these must be the last of Jeff Davis' wild camels, the remnants of a considerable band that once roamed the Great American Desert. In this they were correct, for it was

the last public notice of the surviving fragments of a unique and successful experiment conducted by the United States Army.

It was not a hastily conceived enterprise. As early as 1836 Major G. H. Crosmen had called the attention of the War Department to the possibilities of camels as beasts of burden in wilderness areas. Major H. C. Wayne later made an intensive study of the history of the military use of camels throughout the Near East and in 1848 he recommended their utilization in the deserts of our West.

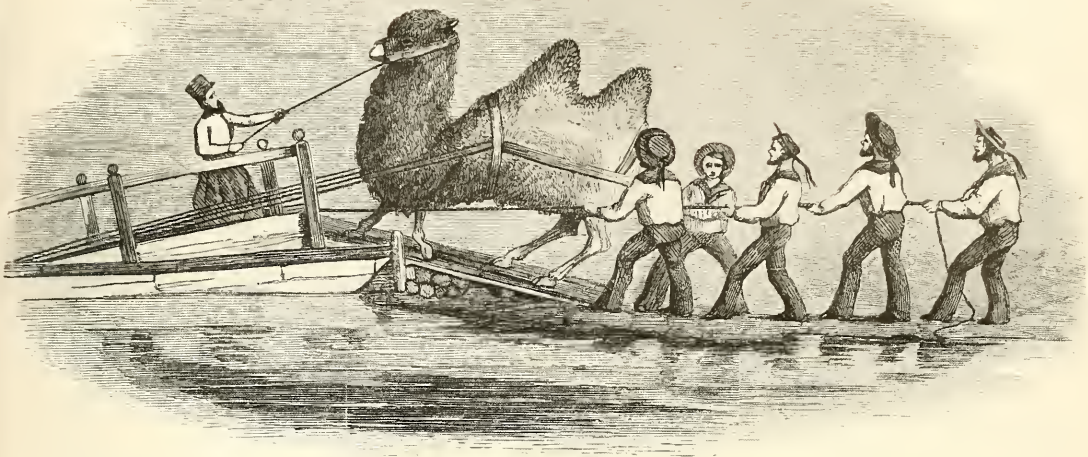
A vast undeveloped land lay between the new settlements on the Mississippi and the old established towns in California—the domain of buffalo and wild Indians; hence the Nation in general and the War Department in particular were vitally concerned with communications between East and West. But a transcontinental railroad was the vision of many, and those who were not faced with the immediate hardships of a journey across the continent were content to dream of an iron horse.

So it was not until Jefferson Davis became Secretary of War that effective steps were taken to investigate the use of camels as transports on this continent where they had once thrived in prehistoric times. From a lethargic Congress, Davis procured an appropriation and from the Navy he borrowed the U.S.S. *Supply*, under command of Lieutenant D. D. Porter. Early in 1855 Major Wayne, having observed camels in the zoological

OVER THIS ROUTE the camel caravan plodded, a source of amazement to every wayside settlement. Each carried a 600-pound load. In a crisis they saved the mules of the expedition from death by carrying water from a distant water-hole. The successful journey from Texas to California and back encouraged the use of camels by private companies, but the Civil War intervened, and camels were forgotten as a means of transportation in the United States

*HOBART E. STOCKING, 37, is the son of a pioneer physician who in 1885 began doctoring cowboys from Texas to Kansas. History first interested Mr. Stocking when he read in his father's account book entries like, "24 pumpkins, 2 steers rec'd on account." When a local veterinarian helped him dig out and identify a mammoth tooth, he learned there was a history older than the Indians. Since then (with the aid of pointers he picked up at the University of Texas, Johns Hopkins, and Chicago) he has been poking in geological corners in Texas, New Mexico, West Virginia, Maine, and Portuguese West Africa. Right now he is Geologist for the Petroleum Administration for War in Pittsburgh, where in spare time he is trying to teach his two small daughters that other people besides policemen ride horses.—Ed.





gardens of London and Paris, met Porter and the *Supply* at Spezzia, Italy. Calling at Malta they carefully selected the first camel. They intended to observe the habits of this initial acquisition while they looked into the use of camels in the Near East.

At Tunis they paid a courtesy call on Mohammed Pasha. This ruler, willing to please the new almost unknown nation somewhere in the west, promised them two fine animals from his own herd. It was Wayne's and Porter's first experience with Mediterranean generosity. One animal was of fair size and condition, the other they disposed of as quickly as diplomacy allowed. The *Supply* called at Smyrna, Salonika, Constantinople, and the Crimea. At the latter place the two men were guests of the British, who allowed them complete free-

THE NEAR EAST was canvassed for camels by a government-sponsored expedition before the Civil War. The purpose: to establish caravan service across the "Great American Desert." This illustration, published in a Senate Executive Document in 1857, shows the loading of camels at a Mediterranean port

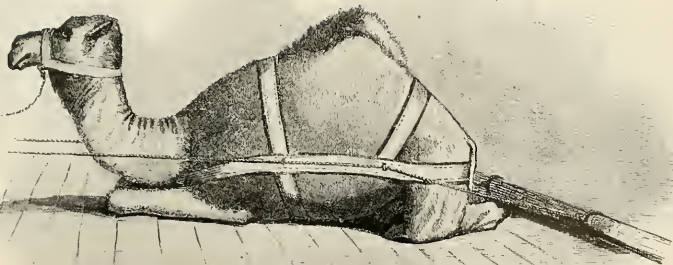
dom in collecting information concerning the utility of camels in the Crimean War, then in progress.

As a camel enthusiast of long standing, Major Wayne looked into every corner of camel lore. He learned that in the Near East the word "dromedary" referred to a racing animal. If it had two humps it was a Bactrian camel, if it had only one it was an Arabian. When Wayne was satisfied with the effectiveness of camels as military transports, he delved into their history, biology, and the nature of the ailments to which they were heir. Wayne and Porter were prob-

ably the first and last authors of a camel-questionnaire. They prepared a list of questions calculated to yield useful information concerning the practical use of camels in any locality and they circulated this among every English-reading consul, agent, Minister, and commercial representative in the Near East. They sifted the answers, probed the disagreements, questioned concurrences until they had more than a general knowledge of the use of camels throughout the Levant.

In February 1856 the U.S.S. *Supply* left Smyrna with a cargo of one booghdee (a hybrid offspring of a male Bactrian and an Arabian female), nine Bactrians, and 22 Arabian camels. In April the ship arrived off the Powder Horn, three miles south of Indianola, the former capital of Texas. It was the first of two voyages, and Lieutenant Porter returned immediately to the Mediterranean for a second load. Very soon 74 camels

Continued on page 431



WHEN SEAS ROUGHENED, Lieutenant D. D. Porter, the officer in command, had the animals brought to their knees and made fast in this special harness he devised. To accommodate the hump of one gigantic animal, a hole was cut in the upper deck

The Coast of Winter Drought

By ROBERT CUSHMAN MURPHY

Chairman, Department of Birds,
The American Museum of Natural History

AT six o'clock on Sunday morning, February 23, "Askoy" lay five miles offshore when the steep mountain wall of the Baudó, piled high with clouds, was first outlined by the rising sun. A brisk north wind was blowing, flecking the ocean with whitecaps. The scene was a simple one, without varied or outstanding features. Yet it was impressive beyond description because there can be few tropical seacoasts more overpoweringly primeval than that of southern Darien.

We had approached during an overcast night, unaware of the strength of the northerly current, and toward dawn had begun to stand off and on until we might learn exactly where we were. By mere chance I now had an opportunity to behave with all the sophistication of a New York policeman giving directions to out-of-town visitors.

In both coastwise directions the shore and the heavily forested ridges were alike obscure, but when sunlight suddenly illumined the sea, I made out, toward the south, the dim silhouettes of two *morros* off Point Piñas with which I had become acquainted in September, 1937. These islets were discernible only because I was eagerly searching for them. They were not noticed by the other members of our group, but they enabled me to inform Skipper Connolly, altogether nonchalantly, that we were ten miles north of Piñas Bay, and quite properly to windward. We therefore worked our Station No. 18, the sixth and final one on the course we had laid from the middle of the Gulf of Panama. We then turned southward and toward shore, and as the morning brightened the landmark of Cerro de Sapo (Toad Mountain), highest peak in the northern part of the Baudó Range, came into view over the coast hills. A great surf was dancing on the rocks below boughs of the unbroken forest, and nowhere was there a sign of human occupancy. A manta or giant ray, at least as wide as the

length of our towed skiff (16 feet), swam past with its upturned wing-tips cutting the surface, and a school of spotted porpoises played under "Askoy's" stem. Before reaching Point Piñas we approached the coast still more closely, in order that I might examine in clear daylight the narrow and hazardous pass between Jicacolito Islet and the mainland, through which I had slipped in the launch "Wilpet" late on a stormy afternoon four years earlier.

Piñas Bay presently opened up as an extensive and colorful inlet running northward toward the base of the main mountain range, which was still sufficiently distant to appear as an ethereal blue monochrome. Many flowering trees peppered the ridge at our left, and the outlines of huts and coconut palms gradually came into view as we headed toward Santa Dorotea, which occupies a crescent beach that separates the bay from the channels and morasses of the Piñas River. The mouth of this small stream, which meanders through several miles of low foreshore, is at the western tip of the spit and, as we afterwards learned, is a choppy and treacherous spot for small craft during the ebbing tide.

At this season, while the winds were prevailing from the north, representing in fact the outer border of the northeast trade-wind zone, Piñas Bay was an exceedingly well sheltered haven. The same is by no means true

during the two-thirds of the year in which southerly winds prevail, as I had learned while bouncing at anchor in "Wilpet" in September. If, however, a modern breakwater of sufficient length could be extended due west from Point Jaqué, just south of Piñas, the bay with its abundant scope and depth, clear bottom of sandy mud, and windbreaks in all directions but one, could be converted into the finest all-season harbor along many hundred miles of coast.

Because of the deficiency of soundings on our chart, we hove the lead along the whole length of our entry, but found plenty of water everywhere and finally dropped anchor in five fathoms half a mile off the Santa Dorotea water-front. Within a few minutes a large *cayuco*, driven by an outboard motor, approached "Askoy" from the estuary of the Río Piñas. It contained six Negroes and a white man, and, of course, we expected an official call. To our surprise, however, the craft passed us at high speed and returned alongside only after I had waved an invitation. The events that followed reminded me that I was not empowered to "manage traffic" on this

➤ A COASTER from the neighboring port of Jaqué visits Piñas Bay. The Negro skippers have, of course, no knowledge of celestial navigation. Nevertheless, they make voyages with full cargoes to points as distant as Panama or Buenaventura *por la costa*, or along the curve of the coast. Because of the steady character of the seasonal winds, one leg of each such journey is likely to be long and difficult



or any other coast. The white man, who was trailing a fish line, introduced himself as a merchant of Panama on vacation. He subsequently

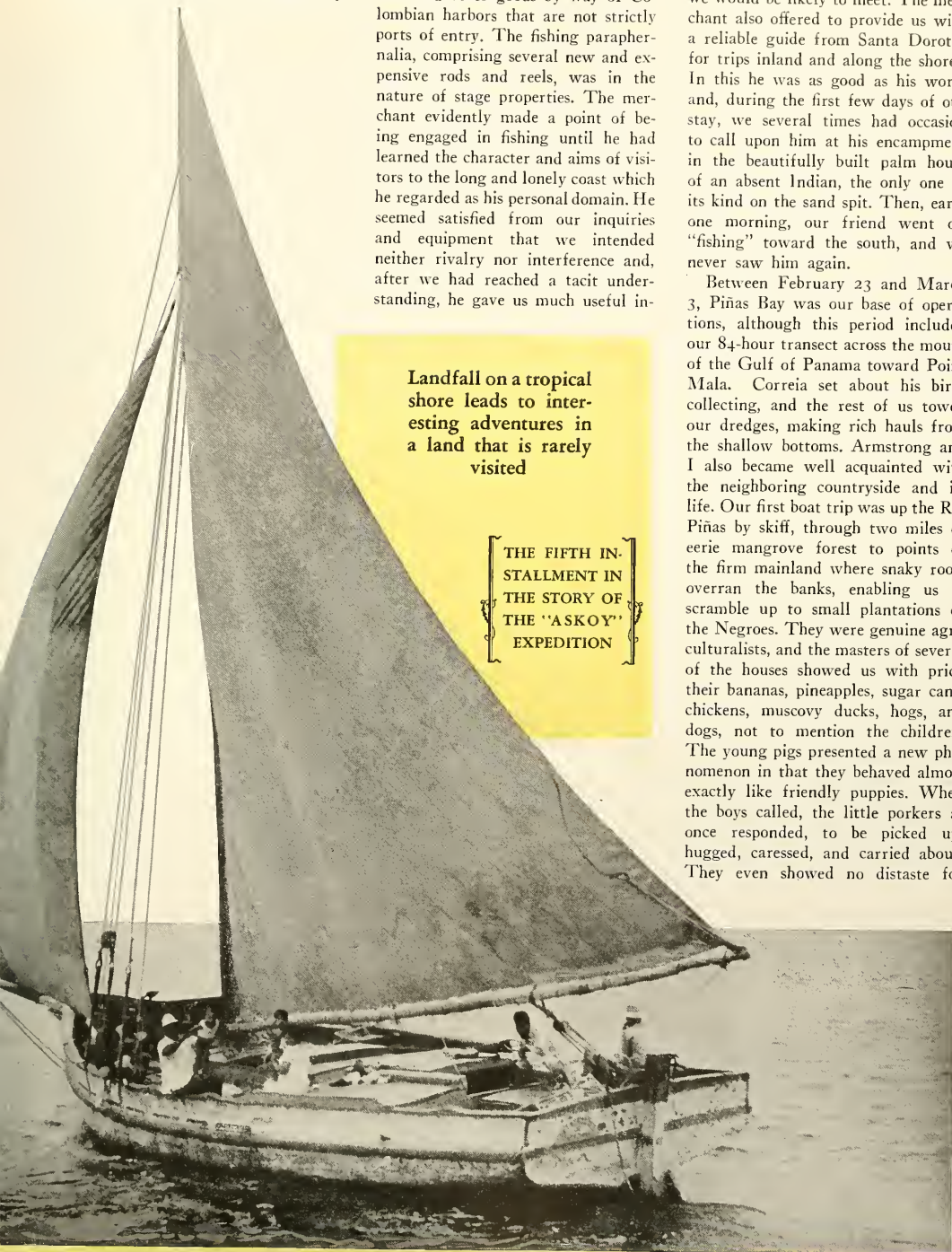
admitted that he was combining business with pleasure to the extent of arranging the importation of Japanese silks and other goods by way of Colombian harbors that are not strictly ports of entry. The fishing paraphernalia, comprising several new and expensive rods and reels, was in the nature of stage properties. The merchant evidently made a point of being engaged in fishing until he had learned the character and aims of visitors to the long and lonely coast which he regarded as his personal domain. He seemed satisfied from our inquiries and equipment that we intended neither rivalry nor interference and, after we had reached a tacit understanding, he gave us much useful in-

Landfall on a tropical shore leads to interesting adventures in a land that is rarely visited

THE FIFTH INSTALLMENT IN THE STORY OF THE "ASKOY" EXPEDITION

formation about harbors and coves in Darien and Colombia and about families, both Indian and Negro, that we would be likely to meet. The merchant also offered to provide us with a reliable guide from Santa Dorotea for trips inland and along the shores. In this he was as good as his word, and, during the first few days of our stay, we several times had occasion to call upon him at his encampment in the beautifully built palm house of an absent Indian, the only one of its kind on the sand spit. Then, early one morning, our friend went off "fishing" toward the south, and we never saw him again.

Between February 23 and March 3, Piñas Bay was our base of operations, although this period included our 84-hour transect across the mouth of the Gulf of Panama toward Point Mala. Correia set about his bird-collecting, and the rest of us towed our dredges, making rich hauls from the shallow bottoms. Armstrong and I also became well acquainted with the neighboring countryside and its life. Our first boat trip was up the Río Piñas by skiff, through two miles of eerie mangrove forest to points of the firm mainland where snaky roots overran the banks, enabling us to scramble up to small plantations of the Negroes. They were genuine agriculturalists, and the masters of several of the houses showed us with pride their bananas, pineapples, sugar cane, chickens, muscovy ducks, hogs, and dogs, not to mention the children. The young pigs presented a new phenomenon in that they behaved almost exactly like friendly puppies. When the boys called, the little porkers at once responded, to be picked up, hugged, caressed, and carried about. They even showed no distaste for



▼ A RESIDENCE of Santa Dorotea and the coasting sloop in which its owner carries produce to Panama. That this is the home of a Negro family is shown by the fact that, unlike Indian houses, it has walls of plaited palm splints



▼ ROBERT FRANÇOIS, mate of "Askoy," inspects a coasting sloop that has been carved in one piece from a tree trunk. Checks and cracks, such as the one in the stern of this craft, are bolted together, caulked with gum, and regarded very lightly. This sloop is ready for decking and the addition of bulwarks



▼ "MAIN STREET" of Santa Dorotea. Callers from "Askoy" are at the village store, which is dignified by flights of steps instead of the notched tree trunks that constitute the "front stoops" of most of the residences. Above the roofs is the abundant crop of coconut palms, which yield products useful to the inhabitants on every day of the year throughout wet and dry seasons alike



strangers, such as John and me, but came crowding toward us with an evident desire to be fondled and to have their ears pulled. It was something quite new in "syology!"

The whistles and cries of birds were loud in the tall mangroves and in the woods of the hillsides beyond. As is usual in the tropical rain forest, however, we could see scarcely anything of the songsters until we came to clearings or to the edge of water. We needed the specimens anyway, and an old rule for identifying birds in a strange and little known region proved a good one: shoot first and find out later. Correia applied it in the valley of the Río Piñas, quickly enabling us to learn that the fauna included representatives of the tinamous, hawks, parakeets, woodpeckers, barbets, ant-thrushes, woodhewers, cotingas, flycatchers, kingfishers, toucans, troupials, pigeons, tanagers, manakins, finches, and many more families.

Along the banks of the river or on bars exposed by the falling tide were several winter visitors from home, including Louisiana water-thrushes, spotted sandpipers, and belted kingfishers. Over a cove of the bay an osprey circled, a bird that I was almost tempted to shoot with the hope of finding a Gardiner's Island band on its leg! The voices of most of the native species were not very revealing, but a few proved unmistakable, particularly the thrilling, almost mystical belling of a tinamou, ringing out from the woodland shades at sunset. I imitated the call as best I could, and the bird answered at once, with strange ventriloquistic overtones.

Conspicuous among the small birds of the Piñas sand spit was a yellow-breasted flycatcher belonging to the same genus as our North American kingbird. Ornithologists call it *Tyrannus melancholicus*—doubtless because it is a tyrant, melancholy to all adversaries! Later in the course of the expedition we found it to be the dominant land bird at every water-front locality. It had, in fact, a particular penchant for rocky islets and tall trees above breaking waves, and was present equally near human habitations and in lonely neighborhoods.

Now this flycatcher showed its relationship to the kingbird not only in physical structures apparent to a student examining specimens, but still more in its living behavior and its strident, chattering calls. "Kingbird" was, in fact, the only name to apply to it when it darted noisily from its

▼ DRY SLOUGHS in Santa Dorotea indicate how the whole village becomes a little Venice during the rainy season. Linger pools in the *quebradas* were full of tadpoles at the date of "Askoy's" visit. Domesticated Muscovy ducks were finding food on the bottom, and basilisk lizards were running spectacularly on their hind legs across the surface



▼ MASSIVE FOREST WRECKAGE at a bend of the Río Piñas suggests the mighty flow of water that pours down in the rainy season from the young and steep Baudó Mountains



▼ GRACEFUL AND STREAMLINED PROWS, made fast by bark cordage to the bank of the Río Piñas, indicate the uses for which these boats are designed. The two with spoon bows are river or still-water *cayucos*. The two with sharp bows are salt-water dugouts, capable of landing through surf



▼ HANGING GARDENS—not of Babylon but of Santa Dorotea. Platforms, or fragments of worn-out canoes, serve as onion beds for the inhabitants. The vegetables are thus kept partly out of reach of ants and rodents



▼ PIÑAS BAY takes its name from the pineapple, one of the many gifts of tropical America to mankind. Numerous garden patches of the delicious fruit are found in Santa Dorotea



▼ THE COCONUT is the meat, the drink, the staff of life, the nectar and ambrosia of the maritime tropics. Regardless of atmospheric temperature, its sweet fluid seems always as cool as well-water. Children even too young to wear clothes can skillfully uncork the nuts with a machete. Here Dr. John C. Armstrong is enjoying a hospitable draught from a *pipa*, or green coconut





◀ **CUERVOS DE MAR** or biguá cormorants, roost overnight on slender twigs overhanging the waters of Piñas Bay

▶ **THE SEASIDE BOULEVARD** of Santa Dorotea, with the curved and golden strand of Piñas Bay at the left. A resident Negress is chatting with a Chocó Indian mother and her two children, who have walked to the village from upstream on the Río Piñas. Like all small boys, the little Indian finds himself charmed by a puppy

▶ **JOSÉ CORREIA**, collector of the "Askoy" expedition, chats with our guide, Pedro González, in front of the only Indian dwelling on the Santa Dorotea sand spit. Houses of the Chocó Indians are characterized by their beautiful construction, low eaves, and the complete absence of walls. This one, rarely occupied by its owners, was the recognized camping ground of temporary visitors to the Piñas Bay village



▼ **NOR** beautiful and delicate growths of fungus on a rotting log above a pool in the twilight of tall rain forest, but, rather, the limy skeletons of staghorn corals, or madropores. The exterior living substance has been allowed to macerate in the fresh water below. The marketable treasure is being dried and bleached for the souvenir trade in the few rays of sunlight that filter through the green canopy



CARVED WOOD is the basis of most domestic necessities in Darien and the Chocó. Here are a sea-going canoe, a pedestaled rice mortar, and (in the lower photograph) a mill for crushing sugar cane—all hand-made and hand-operated





◀ ONE CASH CROP of the coast that has a practically unlimited market in Panama and elsewhere is charcoal. At the edge of a vast *manglare*, or mangrove swamp, near Santa Dorotea is a charcoal burner's mound, or oven, within which the partial incineration of the hard wood is taking place



◀ THE SECOND photograph shows the completion of the manufacturing process. The cooled oven has been opened and the blocks of carbon sacked for export

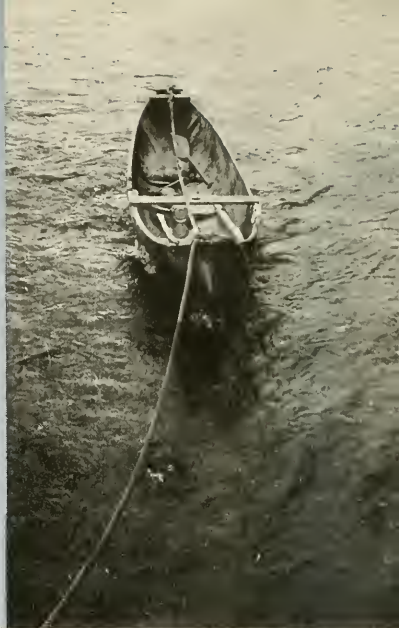


➤ THE OPEN PACIFIC coast of southern Darien and its nearly beachless shores. The site is a cove north of Point Piñas, across a knife-edged ridge from the Bay. Gigantic trees, probably *ceibas*, which are almost leafless in the middle of the dry season, lift their crowns above the general level of the primeval forest





◀ THE LANDING PLATFORM of the Morro de Piñas. Even in a flat calm, it requires skillful oarsmanship to enable a man to leap ashore above the surge and the boat to pull off without staving its bottom



▶ A LARGE AND EXTRAORDINARILY ABLE DUGOUT of lifeboat type, in which three members of the "Askoy" party and two expert Negro boatmen landed and re-embarked through breakers at the beach of Cocalito

perch in hot pursuit of a giant man-o'-war bird. Its actions must have been due to sheer bravado and pugnaciousness, for a man-o'-war could not conceivably molest either it or its nest. In other words, it was merely exhibiting an ancient family trait. But how mysterious and inexplicable it is that the kingbird of North America and its distant relative in South America should have jointly carried down through the ages this congenital habit of attacking all larger birds that unconsciously infringe upon their territory.

Still another bird impossible to overlook at Santa Dorotea—or elsewhere along the Chocó coast—was the *changamé* or great-tailed grackle. It is a relative of our North American crow-blackbirds, but it is so overweighted astern that it has a hard time managing its long tail quills when it walks out on the sea beaches in the full sweep of the wind. Incidentally, the *changamés* are the noisiest birds at their roosts that I have ever heard anywhere. The chorus of a large assemblage sounds like all the rusty hinges and squeaky axles in Christendom.

Santa Dorotea was a curious place, infinitely remote from the world, uniformly black in population except that a Chinese merchant of the neighboring village of Jaqué was owner of the single shop and now and then came in by boat to check his inventory. As I have already reported, there was



▲ PEDRO GONZÁLEZ, iguana-hunter extraordinary of Santa Dorotea and Mr. Correia's guide on a journey to the Baudó Mountains. The tattered garb is strictly a bush costume. At home in the village, Pedro always wore white clothing kept scrupulously clean by daily washings in the water of the Río Piñas

one Indian house in the village, distinguishable by its absence of walls and the superior construction of its thatched roof. It was rarely occupied by the owners, however, for the settlements of the Chocó people were mainly upstream. It served chiefly as an encampment for visiting traders and other travelers, who required no specific permission to occupy it but customarily left an American dollar bill by way of rental, regardless of whether they had occupied the platform for one night or for a week.

The Negroes obtained the greater part of their sustenance from their plantations and the water of the bay. But since they also possessed "store clothes," shoes, pots and skillets, they must also have had cash crops of some sort. Inquiry revealed that cargoes of fruit, charcoal, and a few other products were occasionally sent to Panama. *Carbon de mangle*, or mangrove charcoal, is in fact an historically important fuel for Spanish-American braziers. Around the edge of the swamps we stumbled on a number of large conical mounds of earth in which it was being prepared. We found also another curious marketable treasure of the Chocó. Lying in pools of the Piñas River or bleaching on prostrate tree trunks in sunny glades of the forest were small formations of white staghorn coral, such as are displayed for tourists in the shops of Panama and Buenaventura. The gathering of coral is evidently a wide-

spread custom, because on several later occasions we were startled by luxuriant clumps of "fungi," only to discover that they were the drying spoil of coral-divers.

But whatever the inhabitants of Santa Dorotea did for a living, they had plenty of free time on their hands. In the schoolhouse, which we were told had been abandoned as an educational institution for the past two years, dancing was in progress day and night. Life, indeed, seemed to be a continuous *baile*. We saw it going on under the full sun of noonday, and during both our periods at anchor in the bay there was never an hour of the night in which the stirring thump and booming of the *tambora*, accompanied by frequent shouts in rhythm, could not be heard across the water. The drum, topping a pedestal like a rice mortar, had a rawhide membrane

▼ MR. CORREIA is joined by his canoemen and porters for a collecting trip to the higher slopes of the Baudó Mountains. The large package on the shoulder of the boy at the left is the case, made of wood and bronze screening, in which, with canvas removed, birdskins are dried



▼ SETTING FORTH to cross the lowlands by the meandering highway of the Río Piñas, before the transfer to "shanks' mares" and the incredibly steep trails of the Baudó Range



tightened by wooden wedges and was just such as I have seen in the African collections in the American Museum. We often thought as we watched and listened that, although these blacks spoke Spanish and happened to live in New World forests, the transfer of their ancestors from the Congo had made little change in their outlook on life. Their very household decorations included such incongruous contrasts as a chromo of the crowned Queen of Heaven facing a lurid and seductive Chinese flower girl smiling above a calendar from the opposite wall.

The Church of Santa Dorotea had been neglected even longer than the school. A few of the oldest inhabitants could remember a resident priest, when the local population was 400 instead of 90. Now, we were told, sacerdotal visits from Panama were spaced at intervals of years. On the rare landings of the good father, his first duties were to round up and baptize all the children who had been born since the preceding visit, marry the couples found living together, and read a common burial service over those who had died. Celestial supervision of Santa Dorotea during the long intervening periods was left entirely to a bronze image of the Saint herself, standing on a cairn of stones in a small plaza. Inspection showed that the statue had been cast in a German foundry and that it was one of a large number of duplicates sold by enterprising traders to the inhabitants of small South and Central American communities. The only thing to distinguish it from any other canonized lady was the name plate.

I am not quite correct in stating that there was no other religious tutelage in Santa Dorotea, because we learned that instruction in Bible study was regularly given for all who would listen by a local Seventh Day Adventist, an aged Negro known merely as *El Jamaicano*, the Jamaican. This individual seemed to be the sage of the village, and we called upon him on March 2. He proved to be a dignified and courteous man, who had come from Jamaica to the diggings of the French Canal and had then continued down the west coast in 1888, never returning even as far as Panama. For the past 37 years he had lived in Santa Dorotea, which he liked "because it is quiet." We found him seated on the ground in the shade of

a mango, eating gruel from a tin cup, with his pipe and tobacco beside him. One foot, more or less shapeless and helpless, was resting on a box. Some months before, he told us, he had been bitten by a bushmaster. He had expected to die but had miraculously pulled through, though without yet regaining the use of his leg. *El Jamaicano* remembered his English well. He lived in the only house in Santa Dorotea equipped with a corrugated iron roof and with whitewashed clapboards on its southern, or "rainy-season" side. He owned fenced groves of fruit trees and beds of pineapples, shipped his products frequently to Panama in small sloops, and seemed to be a man of considerable substance.

On the morning after our arrival in Piñas Bay, the "merchant-on-vacation" brought us a guide for our trip to the islets known as the Morro de Piñas and the Morro Centinela, which lie in the ocean just outside. Pedro González, a 26-year old Negro bearing the same name as one of the principal Pearl Islands, was alleged to be a famous iguana hunter whose calling took him regularly to these islets. He informed us, indeed, that he had been on the southerly one when "Askoy" had come into port.

Without setting canvas, we chugged out of the bay on a perfectly calm morning, but there was a typical ocean surge around the rocky platform of the *morro*. As we approached two at a time in our skiff, a giant manta stuck its head out of water. At close range, its other name, devilfish, seemed particularly appropriate, because the visage of the creature was like nothing so much as that of a demon in a Dürer print. Porpoises also came to play around the skiff, and from the deck of "Askoy" Armstrong saw one dash toward a sea snake at the surface, only to stop short and change its course as though it recognized the reptile and the danger. Pedro first landed me by backing close to the jagged ledge and balancing the craft until I could leap ashore. Then he returned to the schooner for Correia. Finally Robert, the mate, landed Pedro in the same manner. I brought nothing but a machete and my Leica camera, the latter sealed inside two waxed bags in a friction-top tin, so that it would float if it fell overboard. Correia brought a shotgun, which, as it turned out, he was not able to use because every bird he might have

killed would have proved irrecoverable.

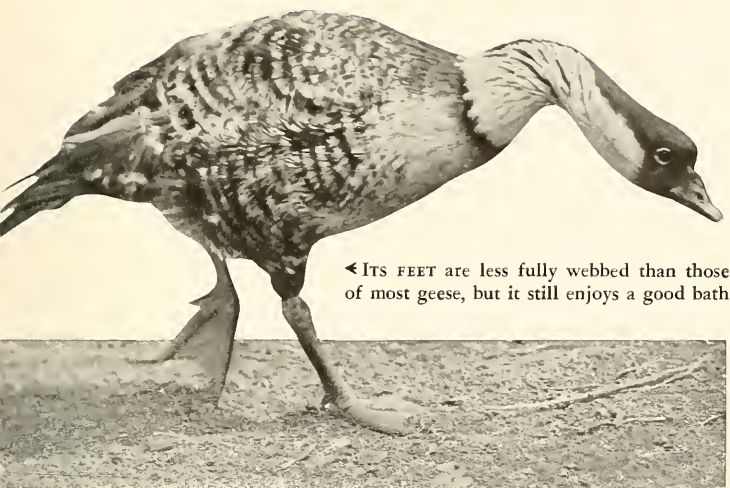
Both *morros*, in the middle of the dry season, presented a very different appearance from what I had observed and photographed from the launch during the rains of 1937. The luxuriance of their vegetation had led me to write after my former voyage that they are "low islets, covered from summit to tide line and from tree top to forest floor with the very quintessence of dark, reeking impenetrable jungle."¹ The relative sparseness of the dry-season plant-cover now raised the curtain and made it necessary for me to revise my former opinion somewhat drastically. Both islets are, in fact, rocky and perhaps 300 feet high. It proved a stiff climb to the summit of the one upon which we had debarked. In places the wall was almost perpendicular, and awkwardly placed tree trunks, untrustworthy vines, and loose stone presented many difficulties. When we reached the plateau, if it might be so called, the going became softer, although the vegetation was so dense that I could at no time catch a glimpse of our schooner below or of the mountains across the water. The variety of plant life seemed to be somewhat limited, but there was an abundance of huge, buttressed trees with ferns, orchids and other epiphytes on their higher branches and a wild tangle of lianas extending toward the ground. Some of these natural ropes supported large termite nests built of mud or cellulose.

A great gorge, into which the sea dashed, cut halfway through this *morro*. Among the plants that covered its damp walls like a tapestry, we saw honeycreepers and other birds, but there was not the slightest possibility of collecting them. My own special interest was a search for breeding places of small petrels, or Mother Carey's chickens, because the west coast of South America is the home of at least two species whose nests have never yet been discovered. With the machete I dug into scores of holes in the soil, and sniffed for the familiar and persistent odor of petrels. Pedro González, who knew the birds well as *Golondrinas de mar* (sea swallows), was sure that they never bred on these islands. All the small holes, he said, were those of land crabs, while the bigger burrows near the summit were the diggings of iguanas. Of the

Continued on page 430

¹ Geographical Review, Vol. 29, 1939, p. 6.

A RARE GOOSE



◀ ITS FEET are less fully webbed than those of most geese, but it still enjoys a good bath

The Hawaiian Goose, or *Nene*, once threatened with extinction, now has a better chance to survive on the slopes of the highest island mountain in the world

By THOMAS M. BLACKMAN

PHOTOGRAPHS BY THE AUTHOR

THE Hawaiian Goose (*Nesochen sandvisensis*) or *Nene* (to use its Hawaiian name) has become more a land bird than a water bird. It is a goose of moderate size, 24 to 28 inches in length, with its grayish-brown plumage varied with black and white markings and with its feet less fully webbed than is usual for a goose.

During the summer months the Hawaiian Goose lives chiefly in the northern part of the island of Hawaii, the "big island" of the group, where it frequents elevations of 4,000 feet upwards, extending its range high up the slopes of the great extinct volcano Mauna Kea, where much of the ground is still covered with rough lava flows, which extend down to the shore line. Mauna Kea rises to a height of 13,823 feet, and is said to be the highest island mountain in the world.

Years ago the Hawaiian Goose is said to have occurred also on the neighboring island of Maui, but it

has long since ceased to exist there. Though it does not leave the island of Hawaii, it descends, in the fall, to the lower land on the southern and western parts of the island, where it probably finds a more abundant supply of suitable food. There it nests and raises its young, laying usually only three or four eggs. It returns to the higher ground when spring appears and the snow melts on the mountain tops.

The Hawaiian Goose has become adapted to the dry regions where, in summer, the rain pools and dew on the scant herbage form its meager water supply. The scant growth of grasses and other herbage, the almost tasteless berries of the ohelo (*Vaccinium reticulatum*), and the wild strawberry (*Fragaria chilensis*), are believed to form its main food supply.

Until about 1900 the Hawaiian Goose was fairly common, but as it is said to have been the practice to hunt this bird in the winter months

during its breeding time and while the young birds were still unable to fly, there is little cause for wonder that its numbers were quickly reduced and that it soon approached extinction. That practice was discontinued when protective measures were introduced in 1907, and although at the present time the Hawaiian Goose is by no means common, it now has a better chance to survive.

Although in some of their natural haunts these geese apparently seldom see much water, in captivity they are very fond of bathing. Mr. Charles Aipia, of Puuwaawaa, in the North Kona district, speaks of occasionally seeing one or two of these birds near the water troughs provided for cattle.

The bird shown in the photographs, believed to be a male, was captured when young and raised among poultry. It associated with turkeys and ducks but preferred the company of a brood of half-grown ducks when it could find them. It frequently took a bath in a shallow water trough, splashing the water by shuffling its wings in the manner usual to most birds when bathing and took a share of the various cereals provided at feeding times.



▲ IN THE DRY REGIONS, rain pools and dew on the scant herbage are its meager water supply

The mineral that once was vegetable governs much of our lives today, and its story takes us back to the days before the dinosaurs

OL' KING

By RAYMOND E. JANSSEN

Assistant Professor of Geology, Marshall College

NEXT to soil and water, coal heads the list of the world's most useful and necessary mineral resources. By means of coal, iron is refined into steel; and with the use of steel, man rules the world. Without coal, our modern form of civilization would crumble, and we might revert to medieval conditions.

In spite of the present importance of petroleum, copper, tin, and other "strategic" minerals, coal is more widely used for a variety of purposes than any other natural resource. Not only is it used as a fuel in blast furnaces, refineries, turbines, locomotives, factories, and homes, but it is also the raw material from which more

than 2000 products are made. When coal is heated in a closed oven, it can be reduced to several basic products, such as coke, gas, ammonia, and tar.

Ammonia, one of these basic products, is used for various purposes, one of which is in refrigerating systems. Thus coal supplies us with both heat and cold. Ammonia is also used in the making of explosives, fertilizers, cleaning fluids, dry-cell batteries, solder, also in the galvanizing of iron, and even for hair softeners in beauty parlors. Coke and coal gas are used for heating and cooking. Coal tar is used directly in the manufacture of roofing, calking, and insulating materials, as well as for certain types of

paved roads. But when further reduced, coal tar supplies us with a vast variety of other products, many of which have come to be vitally essential in war and peace.

From black coal tar are obtained over 8000 kinds of dyes—bright colors of many shades for inks, paints, cosmetics, fabrics, and artificial coloring of foods. It provides us, too, with sweet-smelling perfumes, flavoring extracts, and food preservatives. Saccharin, a rival of sugar, is made from coal. From coal tar also is produced creosote, carbolic acid, naphtha, naphthalene, and a host of different chemicals, including photographic developers and tear gas. Creosote is used to preserve wood, such as telephone poles, fence posts, and railroad ties. Carbolic acid is used in making ammunition, disinfectants, and drugs. Naphtha is an important dry cleaner. Naphthalene is the starting point for

▼ ANTHRACITE or hard coal is much less widely distributed than either bituminous or lignite. Containing only a small amount of volatile matter, it burns with a nearly non-luminous flame. Within the boundaries of the United States are located half of the world's known coal deposits

COAL FIELDS OF THE UNITED STATES

ANTHRACITE ●

BITUMINOUS ●

LIGNITE ●

*After U. S. G. S.
Professional
Paper 100*



COAL

many of the dyes and is also used in the making of insecticides, moth balls, and moth flakes. One of the relatively recent developments in the use of coal tar is its reduction into antiseptics and medicines, particularly aspirin, anacin, and the several sulfa drugs. In the combatting of infectious diseases and in the saving of lives upon the battlefields of World War II, the wonders performed by the sulfa drugs will long be acclaimed. Many of our modern plastics, some of which are destined to supersede the uses of certain metals, are made from coal tar. Best known publicly of these is nylon, used as a fabric in hosiery, parachutes, and other synthetic textiles. One of the best artificial rubbers—neoprene—the entire output of which now goes to our armed forces, is a major “war product” of coal. Eventually much of our gasoline may be made from coal, as is already being done to a great

▼ **ALTHOUGH A QUARTER** of a billion years old, this fern leaf is so well preserved that its tiniest veinlets can be seen distinctly. (*Neuropteris gigantea* Sternberg)

Photograph by Raymond E. Janssen



OL' KING COAL



◆ **A BELGIAN MINER** IN “BLACK DIAMOND.” The sculpture, by Miss Malvina Hoffman, was carved from a humble block of coal when she carved the “Belgian Miner.” The coal was mined at the same time as the sculpture.



275 TO 225 MILLION YEARS AGO

A BETWEEN 275 million and 225 million years ago, forests of huge trees with dense undergrowth spread over the Carboniferous landscape. It was some of the most luxuriant vegetation the world has ever known. The largest trees grew to a height of

more than 100 feet but are represented today by the small club moss and ground pine. The most abundant plants were the seed ferns (*in the foreground*) and true ferns. This view shows the Upper Carboniferous, or Pennsylvanian period. The animal

life included salamander-like amphibians (*Diplovertebron*) at lower right, the large Eryops-like *Stegoccephalian* (*adjacent*) and the giant insect *Meganuron*

extent in England, France, Germany, and Japan, where natural petroleum supplies are limited. These are only a few of the numerous uses of coal. It is today the world's greatest source of energy and the most extensively used raw mineral product.

Only in comparatively recent times has coal been widely used. The beginnings of its use by man are clouded in obscurity. The first written mention of coal is found in the Bible. In Proverbs 26:21 may be found the verse: "As coals are to burning coals, and wood to fire; so is a contentious man to kindle strife." This is believed to have been written about 1000 B.C. I. several later chapters of the Bible, coal is again mentioned. Whether these references apply to mineral coal as we know it, or to charcoal, is uncertain. The word "coal," at first

spelled "cole," originally meant anything that would burn; hence these Biblical accounts may refer to partly burned, or charred, wood or bone. The first certain reference to mineral coal was made by the Greek philosopher, Theophrastus, about 300 B.C. In his writings he refers to "earthy" coals which kindle like wooden coals. Since he compares his subject with "wooden" coals, or charcoal, it is obvious that he referred to mineral coal.

Evidences of the use of coal in Britain have been found in cinder remains of ancient camp sites which antedate the Roman invasion of 54 B.C. It is not until 1180 A.D., however, that records of actual coal mining operations are found. In 1240 the first shipment of mined coal was received in London, and by the beginning of the seventeenth century the industrial use

of coal in England was well established. Coal was also used early in China, but the first knowledge of this was not known to the Western world until recorded by Marco Polo in 1275.

In America, the first mention of coal was made by the French missionary, Father Hennepin, who saw it along the Illinois River in 1679. In 1750 the first mines were started in Virginia; and in 1755 coal was discovered in Ohio. Anthracite was discovered in Rhode Island in 1760, and about 1790 in Pennsylvania.

Surface mining, at places where coal veins outcropped, was the first method of obtaining supplies. Later, the beehive pit method was utilized. Essentially, it amounted simply to digging the coal from open holes three to five feet in diameter. When the

A TYPICAL LANDSCAPE during the Carboniferous period, when extensive deposits of coal were formed, is shown at left. Two of the ten succeeding periods leading down to recent times are shown for comparison. The views are scientifically reconstructed from a vast amount of detailed evidence preserved in the rocks

▼ DINOSAURS had not yet evolved in the Carboniferous period but they were abundant some 90 million years later in the upper Jurassic, shown below. Note the change that has occurred in the vegetation since the coal-producing Carboniferous period

APPROXIMATELY 155 MILLION YEARS AGO



35 TO 20 MILLION YEARS AGO

A TYPICAL FOREST in the Oligocene period (35 to 20 million years ago) shows an assortment of essentially modern broad-leaved forest trees and true grasses. The cat, a primitive saber-tooth, has killed one of the smaller three-toed horses

A.M.N.H. photograph

bottom of the vein was reached, the pits were widened out to the extent that safety permitted. After the coal from such a pit had been removed, successive near-by holes were dug, and the waste materials dumped into the previous pits.

This was followed by slope mining. Some of the surface coal veins are merely the upper ends of layers that slope down beneath the surface. As the coal was removed from such veins, tunnels remained in the places where the coal had been. Continuous removal of the coal resulted in long, sloping tunnels; hence the name "slope mine." At first the coal was carried out of the tunnels in large baskets slung over the backs of the workers. Later small cars were pulled up the slopes by mules or horses. In places where the slopes were very steep,

the cars were drawn up by cables attached to windlasses which were turned around and around by horses. Slope mines are still operated in many localities today, but for the most part subsurface mining has given way to shaft mining.

Shaft mining came into general use about the middle of the fourteenth century in England. This method was developed primarily to obtain coal that was buried relatively far beneath the surface, usually several hundred feet. It is the most widespread method in use today. It consists of a vertical shaft which intersects one or more coal layers at various depths. At each level the coal is removed from the more or less horizontal veins, leaving a network of passages, or entries. Associated with this is the "room and pillar" method of coal removal. This

consists of removing the coal at intervals along the entries and leaving empty rooms supported by walls or "pillars" of coal. After such a mine has been worked to its farthest extent by this method, the pillars themselves may be removed, after which the mine is abandoned. This frequently results in the ultimate caving-in of the mine, and the method can be followed safely only where the overlying surface has no essential value. In many regions where mines extend beneath cities and good farm land, the pillars must remain standing. Unfortunately, nearly half of the minable coal is thereby lost.

Within recent years, with the development of special machinery, strip mining has gained great prominence. It is the cheapest, quickest, and least wasteful method of mining coal. It

is used in regions where coal veins are shallowly buried—less than a hundred feet beneath the surface. Although vast coal beds were long known to lie close to the surface, there was no practical method of obtaining this coal until modern machines were developed for the purpose. Such coal layers could not be mined directly from the surface; and they were not deep enough to be mined by the shaft method because of insufficient roof support. The development of huge electric shovels now makes possible the mining of this coal in extensive areas, particularly in various parts of the Ohio and Mississippi valleys.

The largest of these enormous shoveling machines are about as tall as a five-story building and are mounted on large, caterpillar tractors. When the machine moves along, it simply scoops the dirt and rock away from the top of the coal layer, piling it to one side and exposing the coal to

view. Temporary tracks are then run in on top of the coal, which may now be scooped up and loaded directly into coal cars. The huge shovels work back and forth quickly across miles of country; and because only a few men are needed to operate them, they provide a very economical method of mining coal.

The strip method of mining coal has yet another advantage—of prime concern to science. The great piles of broken rock left behind by the big shovels have become favorite hunting grounds for geologists and paleobotanists interested in research concerning the origin of coal. The fossil collector finds it much more expedient to obtain specimens in the wake of such mining operations than to dig them laboriously from the rocks below the surface. As a result, much additional knowledge has been acquired about the ancient types of trees and other plants that clothed our earth millions of years ago when the coal layers

were being formed. One such region where strip mining is now in operation, about 50 miles southwest of Chicago, has become world-famous for the information it has given science concerning these extinct coal-forming plants.

The plant remains constituting the coal itself have been greatly squeezed and altered by the metamorphic processes which produced it. Therefore the examination of coal samples does not tell us much about the appearance of the plants which formed it. But in the shale layers immediately overlying the coal beds, plant fossils are often so very well preserved that even the tiniest veinlets can be seen and studied. Here are found perfect impressions of leaves, stems, seeds, roots, and sometimes entire tree stumps and long sections of trunks.

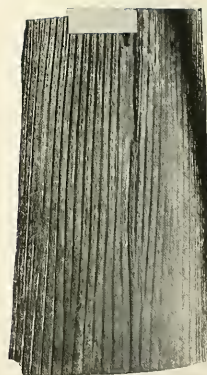
From such specimens it has been learned that many of the trees that flourished in the Great Coal Age



A.M.N.H. photograph

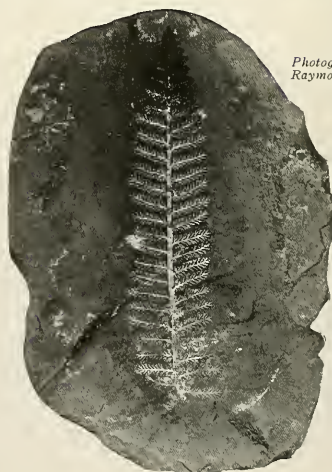
▲ IMPRESSIONS OF FERNLIKE LEAVES are the most common fossils in Carboniferous plant localities. In the past these were thought to be true ferns. But it is now known that many of these plants bore seeds, unlike the true ferns, which reproduce by spores. These "seed ferns" are now classed separately, and they may have been the ancestors of the modern seed plants. True ferns also existed at the time but can be distinguished from seed ferns only by the occasional presence of spore cases. The fossil fern above is *Pecopteris dentata*, from the coal measures near Dansville, Illinois

► THE FLATTENED TRUNK of a characteristic tree of Carboniferous times, well preserved. The coal measures of Pennsylvania near Scranton yielded this fine specimen (*Sigillaria lacoei*)



A.M.N.H. photo

▼ THE VEINLETS are sometimes emphasized by a white carbonate deposit formed from partial decomposition of the plant material. (*Asterotheca candolleana* Brongniart)



Photograph by Raymond E. Janssen

were larger than the average forest trees of today. Their bark, too, was quite different. Some of the trees had large, diamond-shaped patterns, others oval, seal-like designs. These patterns mark the former attachment places of fallen leaves; and strangely, these scar patterns continued to grow in size with the continued growth of the trees even though the leaves had long since fallen from this portion of the stem. The undergrowth of these ancient forests consisted largely of ferns, some of which are the direct ancestors of ferns living today. The vast majority, however, were different, particularly in respect to their method of reproduction. Modern ferns all reproduce by means of tiny spores, carried on the undersides of their leaves; but most of the Coal Age ferns bore seeds or nuts of shapes and sizes similar to present-day hickories, buckeyes, and walnuts. If only they lived today, how easy it would be for us to gather nuts from ferns instead of

having to shake them down from tall trees! Unfortunately, however, all of the nut-bearing ferns became extinct at the close of the Coal Age.

Fortunate it is for us, on the other hand, that vast coal-forming forests grew in the part of the world that was later to become the United States. Within our boundaries are located half of the world's known coal deposits, and from them is being mined today over one-quarter of the world's coal. Sixty-five per cent of this comes from our two greatest coal-producing states of Pennsylvania and West Virginia.

If we survey the powerful nations of today, we find that they are the ones that have ample coal supplies within their boundaries or under their control, which is not surprising when we consider that coal is one of the essentials of modern industrial economy. The countries having the most coal, next to the United States, are Russia, Germany, Great Britain,

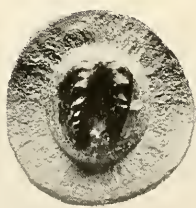
China, and Japan. There is little good coal in Japan proper; most of that nation's supplies come from Japanese controlled Manchukuo which, properly considered, is a part of the Chinese coal region. The desire for adequate coal supplies was one of the major motivating factors of Japanese aggression in China.

Notwithstanding the present importance of petroleum and various "strategic" minerals, coal still remains the world's most necessary mineral resource. Coal is not classified as a strategic mineral by the United States because we have such an abundance of it. Without coal to refine our steel, modern warfare could not continue; and our vast industrial system, dependent upon the use of machines, would collapse. And because of its relative abundance in the world, coal will continue to retain its importance long after the world's supplies of petroleum and other minerals are depleted.

► THE BARK PATTERN of some trees shows long vertical rows of oval leaf-scars. At far right is the subsurface, or underbark, of the same tree (*Sigillaria mamillaris* Brongniart)



▼ SCARS representing the former attachment places of leaves give a curious diamond-shaped pattern to the bark of this Coal Age tree (*Lepidodendron modulum* Lesquereux)



◀ THIS SEED produced by a fern many millions of years ago shows a close resemblance to a modern buckeye with its prickly husk. (*Carpolites noëi* Janssen)



► SPORE CASES like this were borne in enormous conelike clusters on Coal Age trees. They contained millions of tiny reproductive spores which propagated the widespread forests that formed our coal. (*Schopfia deueli* Janssen)

Photograph by
Raymond E. Janssen

The Stingless BEEES

A paradox among the
producers of honey



By HERBERT F. SCHWARZ

Acting Chairman and Research Associate,

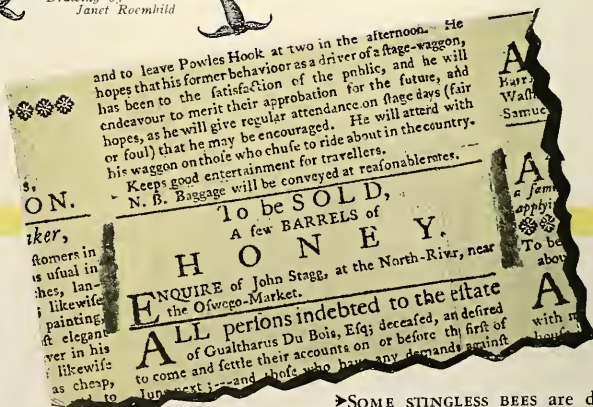
Department of Insects and Spiders,

The American Museum of Natural History

◀ THIS STINGLESS BEE, known to science as *Melipona beecheii*, but sometimes referred to also as "royal bee" or "lady bee," was the one particularly favored for apiculture in Mexico and the Central American countries south of Mexico. A race of it occurs also in Cuba and Jamaica

THE honeybee of the Old World, *Apis*, has so long been a part of our New World civilization that it is difficult to think of it as an alien and introduced insect. After all, we who are new-comers in this New World—even those of us whose ancestral roots are grounded in colonial soil—can hardly dispute the time-honored place in American life that these insect colonists share with the early pioneers. One would like to think that even on the "Mayflower" there may have been some honeybee colonies, but there is no concrete evidence, so far as I know, to support such a belief. However, the honeybees' arrival on our shores must at least have followed soon after that of the Pilgrim Fathers. John Josselyn, who visited New England in 1638 and again in 1663, found the honeybee thriving exceedingly in that area. Indeed, so closely associated was this insect with the colonists that the Indians called the honeybee "the white man's fly" and were wont even—the authority is no other than Jefferson—to anticipate the encroachments of white civilization by the foraging range of this honey-gatherer. By the time Washington's second term as president had been completed honey-

Drawing by
Janet Roemhild



Courtesy of William P. Comstock

▲ HONEY of the Old World honeybee was relished in the United States even in colonial days, as indicated by this advertisement that appeared in the Supplement to the New York Gazette and the Weekly Mercury on April 26, 1773. But stingless bees are found in the Western Hemisphere only south of the United States

► SOME STINGLESS BEES are drab in appearance, but others have facial ornamentation that is rather striking, as shown by this worker of *Melipona favosa*, photographed head-on and enormously enlarged. The mouth parts employed in gathering honey are thrust forward in this specimen

bees are said to have been established on the farther bank of the Mississippi. Thus in a way the honeybee has nearly as good a claim to being a part of America as we know it as have the descendants of the human pioneers.

If, however, we take a larger view of history—insect history as well as human—the honeybee, like the white man, is a late arrival in this New World of ours, for in the long ages that preceded the Discovery, *Apis* was confined in its exploitation of nectar and pollen to the floral pasturage of the Old World. What resource, then, did the aborigines of the New World have, to satisfy their craving for sweet things? After all, sugar cane is a plant of the Old World and, like the honeybee, became established in the American tropics only in post-Columbian time. Are we to conclude accordingly that the red man was entirely without native supplies of sweet things before the white man made available to him sources of honey and of sugar?

The answer to this question may prove surprising. Not only were there native sources of honey—at least in the tropical areas of the Americas—but in parts of those areas there was a thriving apiculture. The producers of wild honey in pre-Columbian America were the stingless bees—still a potent source of supply for the native to this day—and favored species among the stingless bees were definitely domesticated, especially, it would seem, in Mexico, Central America, and northern parts of South America.

The very designation “stingless bees” sounds like a factual negation, for is not the sting one of the most fundamental equipments we associate with a bee? The stingless bees, it is true, are not wholly unprovided with

a sting. There are the atrophied remnants of such a weapon still traceable, but the weapon no longer functions. Nevertheless, such is the persistence of an ancestral behavior pattern that these bees in attack will sometimes apply the tip of their abdomen to one's head or hand or other exposed parts of the body in a futile gesture of stinging, even though they are impotent to inflict the wound. For making themselves unpleasant, however, they rely far more on their mandibles, with which they give little nips, and, when a substantial number of them are all nipping simultaneously, the effect is impressive. In most stingless bees the mandibles are at least partly toothed, and in two of the subgenera there are teeth extending from end to end along the biting surface.

Even when stingless bees do not bite—and the different species differ much in aggressiveness—they nevertheless can be very annoying. They have an unpleasant habit of exploring the anatomy of their victim. They penetrate with zeal among the hairs of the head, enter the portal of the nostrils and ears, and some of the species of minute size even visit the eyes in their relish for the moisture gathered there. Perspiration is also lapped with eagerness.

A few forms belonging to the sub-

genus *Oxytrigona* make themselves even more effectively unpleasant by depositing a caustic fluid. The spots where the bees deposit their “fire” (and in certain parts of South America these insects bear the expressive designation “fire-defecators”) may remain sensitive for days. The evidences of searing may still be traceable, according to those who have been victimized, for several weeks or even as much as two months after the occurrence. So disconcerting is the method of attack, making calm observation difficult under the circumstances, that it is perhaps not surprising to find divergence of opinion as to the origin of the fluid. One group of meliponologists holds to the viewpoint that the fluid is injected from the mouth in the act of biting or subsequent thereto, while another school maintains that more probably the fluid issues from the anus after the manner in ants of the subfamily Camponotinae.

Those who are familiar only with the honeybee may find it hard to believe that certain stingless bees are indeed bees at all, so different are they from the orthodox conception of the layman as to what a bee should look like. Indeed there are species within the Meliponidae, the family name of the stingless bees, so diverse in size and in appearance that, viewing the

▼ THE GREAT RANGE IN SIZE among stingless bees is exhibited in this close-up of the Lilliputian *Trigona duckei* and the Titan *Melipona flavipennis*, both approximately life-size. The dwarf first became known to science through specimens that entered the eye of an entomologist. In Brazil its popular name is “eye-licker.” It is the smallest of all known bees



ACTUAL SIZE

A.M.N.H. photograph

A.M.N.H. photograph



extremes only, one would conclude that they belonged to alien groups. Yet so intergraded in form and in size are the various constituents of this large family that some students have given up trying to separate them into different genera and subgenera and have reduced the whole complex to a single genus, *Melipona*, to the obliteration of *Trigona* and its subgenera and of *Lestrimelitta*.

The tiny *Trigona duckei*, the dwarf of all the bee world, not only differs in its wing venation and in body characters, as it does in size, from the robust *Melipona fulvipennis*, with which it is contrasted in the photograph, but it builds its nest on a different plan. Like all stingless bees, both of these species are colonial. However, whereas the giant constructs successive, horizontally placed combs

of closely fitted brood-cells, one cell contiguous to the other and on the same level, the dwarf does not arrange its brood-cells in combs but in clusters with tiny pillars of wax connecting the otherwise independent cells. Some stingless bees of the genus *Trigona*, in other respects not closely resembling the midget, are faithful to this more primitive type of architecture, but the vast majority of *Trigona* build their brood-cells in combs as do the species belonging to the genus *Melipona*, thus presenting one of the many paradoxical situations that confront those that are interested in tracing relationships among the stingless bees.

The method of building these brood-combs is at variance with that practiced by the honeybee but seems from the human standpoint, at least, architecturally sound. For these builders

construct their nest story by story from the ground floor upward, with supporting elements in the form of minute columns keeping each level distinct. Our Empire State Building with its 102 stories has tended to dwarf the Woolworth Building with its mere 60 stories. And yet it was not so long ago that the Woolworth Building captivated the imagination as the most aspiring accomplishment of man's effort to penetrate architecturally the high reaches of the sky. Even 40 stories is, therefore, not to be dismissed as insignificant; yet a nest consisting of no less than 40 stories has been recorded of a stingless bee, while nests composed of more than 25 stories are in some species not too unusual.

In addition to the brood-combs the stingless bee nest has irregularly clustered honey- and pollen-jars, filled with supplies for the future welfare of the colony. These containers are in some species as large as a fairly sizable hen's egg; in others, much smaller.

Rarely does the spectator have a chance of viewing the nest structure in its interesting details, for the stingless bees usually choose as their building site some concealed hollow and, even when they build in the open, they envelop the significant interior of the nest with a wide outer enclosing wall that assures privacy for the nest occupants and discourages Peeping Toms. Frequently the nest is placed in the



Photos by V. W. von Hagen

▲ EVEN TO THIS DAY honey of stingless bees is relished by the natives of different parts of Central and South America. Here two Jicaque Indians of Honduras are pouring honey from a hollow log occupied by a domesticated colony

➤ THE STOPPER having been removed, the honey flows from the log into a bowl



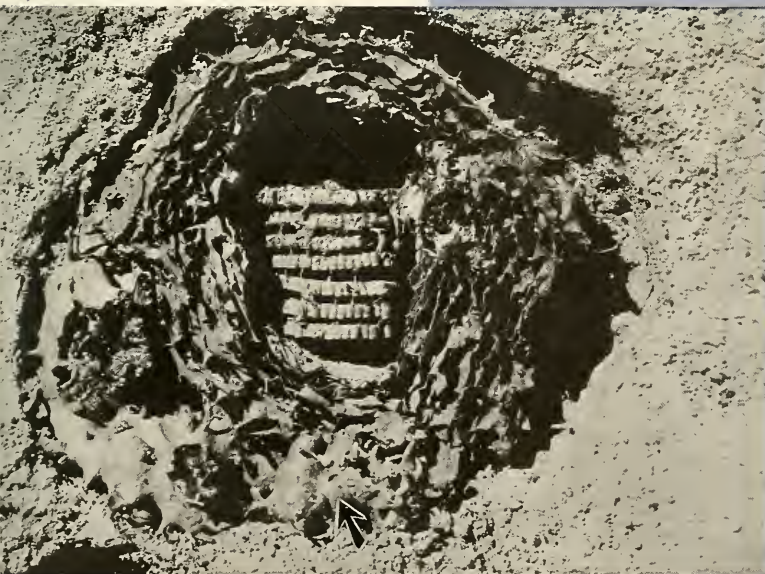
interior of a hollow tree or in the walls of a building but, somewhat according to the species, may also be located in the structure of a termite, or in an ant colony, or in a bird's nest, or among bromeliads, or on the branch of a tree, or in the earth, or plastered against a cliff, or in a dozen other likely or unlikely places, including a letter box, an oil can, and even the tenantless skull of a man.

Often a funnel-shaped or trumpet-shaped spoutlike entrance marks a nest that, except for this external feature, is concealed in a tree hollow, and the character of this portal is sometimes a clue to the species within. The orifice, if small, is occasionally guarded by a single bee, but a whole company of vigilantes may be lined up for defense along the inner wall of a protruding and spacious portal of admission. At night or in inclement weather the entrance to the nest is frequently sealed.

There is need for such protective devices on the part of these bees, for they have many enemies. Ants, with a fondness for sweet things, are always on the watch for any relaxation of vigilance or any breach in the fortress that may give opportunity for a storming party. Cockroaches have been known to overrun the nests of stingless bees. Wasps occasionally try to gain admission to the remote pantry of the hive. But the worst invertebrate enemies of the stingless bees

Continued on page 426

Photograph by W. Weyrauch



▼ HOLLOW TREES are favorite nesting places of stingless bees. Many escape the attention of man, but the nest spout of *Lestrimelitta limão* is particularly ornate

Photograph by O. E. Shattuck



▼ A SMALL STINGLESS BEE with the pretentious name of *Trigona lineata* variety *nuda* selects as its nest site the deserted fungus chamber of a leaf-cutting ant. Well below the seven brood combs may be noted the bulging jars in which the bees store honey



Photograph by H. von Ihering

▲ A FEW SPECIES of stingless bees build exposed nests on the limbs of trees, with the limb and twigs sometimes penetrating the inner structure. *Trigona ruficrus*, the architect of this aboreal nest, is an aggressive bee that produces honey of poor quality

HE turtle came into the world after this fashion.

Within the egg-shell, the infant reptile writhed and strained against the walls of her spherical white prison. All around her the white eggs, looking like small ping-pong balls, were moving jerkily. Some had already ruptured and their occupants had bored upward through the thin covering into the light and air of a warm September morning.

There were 25 eggs in the clutch, not an exceptional number for the big snapping turtle who had placed them there in a vase-shaped hole she had dug in the moist sand of the melon patch nearly four months before. She had never come back to see how her prospective brood had fared, and she doubtless never knew that, of the several snappers who had laid eggs in the same field that morning, hers were the only ones which had escaped the keen nose of that nemesis of all snapping turtles, the striped skunk.

Again the infant turtle twisted and struggled, and the thin, weakened shell suddenly parted in a wide rent. Through this opening she thrust first her head, next her broad front feet, and soon wriggled free. Others before her had already made a path by breaking through the loose soil above, and after a brief upward climb, she stood outside the nest blinking in the bright sun.

Speculatively, she thrust forth her thick, pointed head, withdrew it quickly, and then again poked it inquiringly forward. A dozen of her brothers and sisters milled slowly about her, the whole brood alike as if cast from the same die—dull gray, half-dollar size, rough-backed, thick-necked, and with a high, sharply keeled tail nearly as long as the body. Presently, obeying an instinct that took her toward the lowest point on the horizon, one of the group headed straight for the nearest water, a deep pool at the foot of a steep bluff edging the field, and soon the whole crowd were following the leader in a long, ragged line. After many haltings and neck-cranings, 23 of them reached the water; one had been picked up by a blue heron and another gobbled by a bullfrog. At the water's edge the turtle tentatively put forth her head, then unhesitatingly slid into its brown depths.

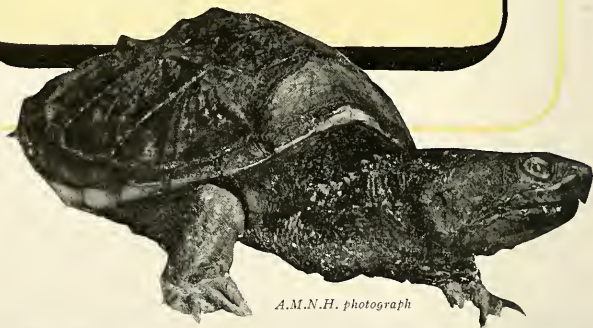
Nature grants to each of the chelonian tribe a slow maturity and the possibility of a long life, this last be-

THE *Turtle*

By ROY L. ABBOTT

Professor of Biology, Iowa State Teachers College

The life story of a huge snapper leads us into a strange dank world that is soundless but full of color, and we see something of the age-long struggle through which the reptile tribe has held a place on earth



A.M.N.H. photograph

TOOTHLESS but equipped with knifelike edges, the powerful jaws of the snapping turtle can dart forward with the speed of a boxer's fist. The illustration shows a 7-inch snapper, but some grow to be over two feet long. The animal is found east of the Rockies, from the Gulf of Mexico to southern Canada

ing realized only if the individual escapes the dangers of its early years. And this turtle, miraculously, had escaped them. For of the 23 turtlelets who had entered the water the day of her birth, she alone had been guided safely past the mouths of a score of hungry predators. And now fifteen years of living had transformed her from a soft-bodied, helpless hatchling into a hard-bitten, hard-biting 30-pound bundle of bone and muscle—a ferocious hunter of the very creatures that had once hunted her.

The turtle's world was a shadowy, watery one, a place of ooze and slime and weeds and old logs, but she fitted it smoothly as did the fishes and the snail-clam tribe, and the insects and

the worms and the water rats around her. Knowledge of this world came to her in part through her eyes—keen yellow-black eyes which not only gave her clear pictures in natural color of her surroundings both in air and water, but which were set so near the end of her nose that she could see and breathe while exposing only a little of her body.

Yet for all its color and form, the turtle's world was a soundless one. This, too, in spite of the fact that she possessed good middle and inner ears. For if her ancestors had ever used them as receiving organs for sound waves in air, that use among her kind had long ago gone out of fashion. Hence, whether sliding among the

sunken logs at the bottom, threading the devious paths through the water weeds, or prowling openly along shore, her environment was one of perpetual silence. Which is not to say that to the turtle the world was a place only of things seen. It was known to her in slight degree at least through smell and taste, and as with her relative, the snake, it had other, even subtler means of impressing itself upon her. It came to her as a thing of temperatures felt through exposed skin, as pressures and strains and contacts picked up by sensitive nerve-ends, and in particular by delicate vibratory nuances, imparted through the bony box that covered her—nuances felt as the flick of a minnow's tail against her shell, the weight of a leaf upon her back, or the tremor of a log jarred by the soft sucking of a carp. Thus through agencies other than eyes and ears was the world made apparent and meaningful to the turtle.

Half or more of the turtle's fifteen years had been spent in that strange, semi-living state known as hibernation. Her blood had no temperature-regulating device of its own, so it heated or cooled with its surroundings. Hence each October, stiffened and slowed by the chilling water, she buried herself in the mud at the bottom below the frost-line and waited for April's sun to warm it again to her liking. While thus hibernating she existed at the expense of fat she had accumulated the summer before. During each summer she hunted and gorged herself to lay up more fat against the lean period of the coming winter.

Not that the turtle knew why she did any of these things. When her stomach was empty, the smooth muscles simply contracted and impinged upon nerve endings embedded there, and the impulses thus set up were interpreted in her brain as hunger. Orders went next from brain to legs, and soon she was prowling for food.

But mechanical as was the physical basis of her hunger, she set about to satisfy it with a deadly intent and precision. When prey was sighted, say a frog or a tadpole resting on the bottom a few feet ahead, the turtle moved toward her victim in the manner of all stalking snappers: head thrust stiffly forth and held steady, her body floating almost imperceptibly forward. When within easy reach, her mouth would open suddenly and flash ahead with the speed of a box-

er's fist, then close with a sharp snap.

Sometimes when young ducks or muskrats played at the surface, she arose from beneath to drag them under. Any living thing, not too large—fish, flesh, or fowl—was grist to her terrible mill. Snails and insects were eaten when nothing better sufficed—sometimes even plants when she was desperately hungry.

Now and then when food was scarce and hard to come at, the turtle ceased her stalking and lay quietly at the bottom, her body buried in the ooze and with only her head flush with the surface. Next her long wormlike tongue would be protruded, and if some unwary fish came to investigate the lure he was quickly and violently snapped up.

The turtle had no teeth. But the margins of her horny jaws were thin and sharp as steel and hooked above and below like the beak of an octopus. These jaws—three inches in spread—were set, at the end of a muscular neck as thick as a man's upper arm, and when they had once closed upon a victim, even a big bullfrog was perfectly helpless. If prey was not too large, she swallowed it whole with a few great gulps. If it was a large creature—a half-grown muskrat, for example—she held it in her jaws and tore it and stretched it with her powerful front legs until it was of swallowable size.

But the urgent voice of hunger was not always easily stilled. Often, as she glided upon her prey, as if prodded by some subtle prescience, the frog or dragonfly would flash away at the very instant of her stroke and her jaws would cleave only water or a tangle of green pond hair. Often she went hungry. When hungry, she hunted incessantly; when satiated, she rested and slept. Her days were commonly a feasting or a fasting.

COSMOS WITHIN A COSMOS

Just as the turtle was a part of the pool in which she lived, one living unit among the ensemble of plants and animals that made up her little world, so, too, was her own body a pool, so to speak, a microcosm of which she was the center. On her broad back, for example, was a dense growth of algae in which tiny snails and crustaceans played. More obvious, but known to her only through vague, uncomprehended irritations,

were two or three score of leeches, many of them inch-long worms that gripped her body powerfully by suckers—parasites who secreted themselves in the flesh around the base of her legs and tail and in the tender pits around her eyes, each taking a toll of her blood as it pleased. Likewise, was the turtle a host to more sinister forms. A tapeworm lived in her intestine—a loathsome, jointed thing which gave off ripe eggs to the outside, eggs designed to be eaten by some other creature upon which she, herself, preyed, thus to come back half-developed into her body. Along with the tapeworm, in the dissolved food of the intestine, round worms lived, and amoebae; and other flatworms invaded even her bladder and her heart. But none of these creatures she housed were killers like herself; Nature had indeed taught them to take without giving but not to the extent of destroying the giver.

ANOTHER GENERATION

In her fifteenth year, the turtle became aware of a new urge. Some weeks before, she had met and momentarily consorted with a huge male of her species, and now a strange thing had come upon her. Her hunger was less insistent, there was little desire for hunting, and vague internal stirrings moved her with a sense of visceral pressure and crowding of her organs. So, one morning in early May, leaving the creek's bed, she climbed slowly and laboriously to the top of the steep bluff. Here after a moment's rest she set out straight across a meadow through a hedge and into the soft sand of a melon field. In this field she stopped and after craning her neck in all directions as if to discover a possible enemy, began to dig a hole with her hind feet, using them alternately to scrape loose and scoop out the moist sand. In perhaps an hour she had dug a vase-shaped hole of half-gallon size, and in this she laid 20 round, white eggs, for all the world like ping-pong balls except for their slightly smaller size. Again using her hind legs she kicked and scraped sand over the eggs and packed it down by pressing with her feet. When the job was completed, she crawled away toward the creek without once looking back, just as her mother had done before her in the same field and near the same spot.

Whitetails

By WILLIAM H. CARR

Director, the Beaumont Newhall
Frederick A. M. Museum,
Assistant Curator, The American
Museum of Natural History



The graceful animal upon which the lives of many of our early settlers depended has increased in numbers in many of our States and provides an interesting subject for observation

All photographs from Palisades Interstate Park Commission by Harold K. Whitford

WHITETAILED DEER provided many of the necessities of life for our Eastern Indians and for the white settlers of America. Their pliable hides, excellent flesh, the very marrow of their bones, and their strong sinews often spelled the difference between relative comfort or hardship, indeed between life or death for many a frontier family.

Despite 300 years of relentless hunting and industrial expansion, there are probably more deer in certain wooded areas of many of our States today than in primitive times.

The animals thrive in regions of abandoned farms or of second growth trees and shrubs where there is an abundance of food and cover. Thickets are more to their liking than virgin forests where lofty trees carry desired buds and leaves far above their reach.

Enlightened game laws and the creation of dog- and gun-free sanctuaries have helped preserve the White-tails, but outstanding credit for their survival must go to the adaptability of the deer themselves, animals well worth knowing.

Nature gave our deer a white flag and, to beat a quick retreat, high-stepping legs. This fleet-footed resident of many of our States believes in discretion, although it by no means lacks valor. When alarmed, it bounds away, instantly raising its tail straight into the air, revealing a strikingly white undersurface, a true snowy banner, flung upward in recognition of danger. This hair-trigger device is symbolic of the animal's high-strung and sometimes contradictory behavior.

On several occasions we have stalked deer only to send them dashing into the underbrush on fear-driven legs. When we stood perfectly still for a time, they would slowly return, to view the object that had startled them. We once watched two does approach for 50 feet through an open meadow to investigate the

whirring sound of a motion picture camera, regardless of the fact that the cameraman's arrival had originally sent them into unhesitating, headlong flight. Seasoned hunters have taken advantage of Whitetail's bump of curiosity to shoot luckless individuals.

It is believed by many that the deer's eyesight is not especially good. Their cautious, uncertain approach toward something that interests them, does suggest the actions of a myopic person who, having forgotten his glasses, cranes his neck and peers ahead, as though unhappily aware of his defective vision. Surely their acute powers of smell and hearing are unexcelled. Their long ears are seldom still, being directed now here, now there, in a ceaseless effort to gather any sounds upon the wind. Certainly the senses of the deer are well suited to its mode of existence and have been through the changing centuries.

Unmolested Whitetails spend a great proportion of their lives in relatively limited areas when food is available the year around. So marked is this habit of clinging to the home range that we have learned to look for certain well-known deer families in specific places along roads and trails in the large sanctuary-park where we live. Sometimes in fall and winter, the animals may gather in small bands and wander for short distances to seek additional food. In general, however, they occupy restricted territories.

We know that a particular old doe may, as a rule, be found in or near a particular beaver swamp; and we may be reasonably certain of seeing a lame doe and her young in the vicinity of a bog beside the same road. A family of deer have lived near our cabin for the past three years. While the handsome buck is absent or unseen over considerable periods of time, the doe and her fawns remain in the neighborhood consistently, despite the fact

that we make no attempt at artificial feeding.

The mother and her young usually appear in the early morning and late afternoon, although we have watched them at various other times during the day and evening. We have also come upon them late at night in our dooryard. In the main they seem fairly regular in their daily routine and habits.

The most interesting event in the life of the deer occurs in the spring. Several years ago, on the first day of June, "our" doe gave birth to two perfectly marked, spotted fawns, within 500 feet of our cabin, in a heavily wooded ravine. We first saw the infants when they were only hours old, lying in the leaves beneath a small white oak. We watched from a distance and took pains not to startle or disturb them. They lay with their miniature legs doubled up and their heads stretched forward on the ground, ears back, motionless, as though part of the quiet landscape. The parent was nowhere in evidence.

By coincidence, on the very day our twins were born, a friend brought in a tiny, unresisting fawn, weighing three and three-quarter pounds, found beside a road some miles distant. We have raised many fawns through the years, but this one was the smallest. The youngster's mother had met with an accident, and we kept the baby and named it "Bambi," thus finding ourselves with one fawn in the hand and two in the bush.

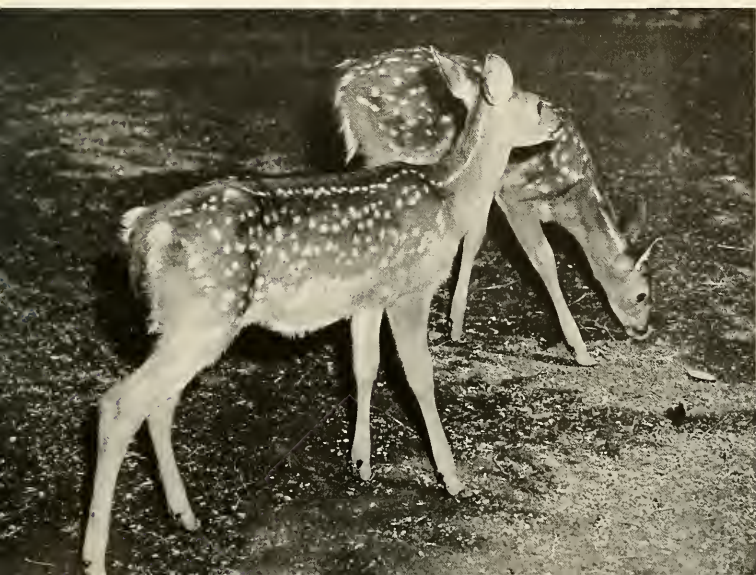
Throughout the summer we frequently saw the wild mother and her offspring, but she did not regularly bring the fawns into view until the warm weather was nearly over. Then the young one's spots were vanishing and the tan coats were imperceptibly changing to winter gray.

Our captive fawn had developed almost as well as the ones that enjoyed their freedom regardless of the



▲Slippery, hard-crusting snow spells hardship for deer. This one is experiencing difficulty regaining its footing

▼These fawns are four months old. Their spots will disappear before winter comes, and their tan coats will change to gray



substitute cow's milk formula. If the doe experienced as much difficulty weaning her infant as we did with little Bambi, we pity her. Bambi insisted upon the nursing bottle until late fall, much later in the year than other fawns we have brought to adulthood.

If there is any animal more truly appealing, beautiful, or helpless than a very small Whitetail fawn, we have never had the good fortune to see it. Captured when very young and carefully reared, they become unbelievably tame, showing no fear of people whatsoever, trotting about with an air of independence upon stiff little legs, following one like an affectionate, overgrown, and sometimes playful puppy, exhibiting perfect confidence in their foster parents. One who has raised a fawn dislikes to have it grow up and thus end the enjoyment that may be brought only by the presence of young animals. But grow up they do, and fast too.

With the arrival of the first truly cold days of winter, woodland fawns, still in the company of their mothers, are faced in a very serious way with the problem of survival, for the snows

and the low temperatures bring real hardship. The nourishing leaves, grasses, and other favorite foods are now difficult and often impossible to secure. Twig tips, the leaves of certain evergreens, plant buds, and even roots and bark are eaten by hungry, snowbound deer. Gone are the days when the parent and her young may wade into some still pond in quest of delectable water plants.

When blizzards, ice storms, and deep snow are the order of the day, the Whitetails often seek food and



▲ Too exhausted to move, this winter-weakened deer lies on a hay pile to rest during a period of dearth



▲ A Bear Mountain Ranger, equipped for winter travel, carries an unresisting wild deer to warmth and food

shelter on the southern sunny side of hills or in the lee of rocks, dense clumps of shrubs, or at the foot of large trees. We have found oval depressions or "forms" in the snow in evergreen forests made by the warmth of the animal's bodies as they lay upon the hard snow surface to rest, when the thermometer registered well below zero and winds raced straight out of the North.

Deer are hardy animals but by no means exceptionally impervious to physical grief. When a smooth, treacherous, thick crust of ice covers the snow, deer have great difficulty in moving about in search of food. Failing to obtain nourishment for any reason whatsoever, the weaker ones succumb unless man comes to their aid

with grain, alfalfa, or other acceptable, life-saving sustenance. Even drinking water may be unavailable, locked beneath solid ice covering small brooks.

Deer may perish upon slippery ice surfaces of lakes when, possibly in a weakened condition, they slip, fall, and find it impossible to regain their feet. Once we came upon an animal in this predicament, and through the use of a small fallen tree we were able to push him to the edge of the lake, whereupon he struggled to his feet and staggered into the woods, windied by fright and exhaustion.

We have rescued many adult deer as well as young ones that were almost too weak to stand, bringing them indoors and feeding them, only

➤ A meteorologist, from tower station atop Bear Mountain, gains the confidence of two hungry deer



to have some fail to respond. Others, however, survived and eventually gained sufficient strength to warrant their release when warmer weather came. A hardheaded realist once chided us for our activities in deer rescue work, saying that we were only interfering with Nature's way of removing the weaker and preserving the stronger. We believe that he had never been face to face with a starving doe and her thin young ones, barely able to walk, upon an ice-bound woodland trail.

Experience has taught that any cornered wild deer is potentially dangerous and should be handled with caution even though weakened with hunger and disease. Their tempers are uncertain, and they may very easily misinterpret one's motives. Their exceedingly sharp front hooves may suddenly be raised and brought down like poniards, with disastrous results to well-intentioned but uninformed persons. We have narrowly escaped this sort of injury on two occasions, with considerable temporary damage to the nervous system in each instance. Once we had a large button neatly removed from the front of our coat by the swiftly descending hooves of an embattled deer. Others have not been as fortunate. Tame deer, as well as recently captured ones, may turn upon their keepers without warning, and fatalities have resulted.

No, the deer is not always a docile animal, indoors or out. This is especially true in the fall, when the sleek, confident bucks with newly acquired, glossy antlers, seek the more than casual companionship of equally attractive but more restrained does. Furious battles may occur when two bucks fasten their attention upon the same doe or in some other way invade each other's bailiwick. When deer fight, all caution is thrown to the winds. We have examined deer with deep scars that were doubtless the result of conflict with others of their kind.

Not many years ago two fine bucks, weighing approximately 150 pounds each, fought to the death in our park. The evidence showed that they had rushed at each other repeatedly and clashed head-on with terrific impact. In one of their collisions their shapely antlers became so firmly locked that the gasping animals could not free themselves, strain as they would. At last they sank to the ground and died, with antlers still united. The scene

was easy to reconstruct, for the earth was torn up, shrubs were broken and trampled, and the entire area bore the marks of an appalling struggle. The neck of the smaller animal was found to be broken when we discovered the two bodies not many days after the contest.

Mating preliminaries are of course by no means always violent. We once watched the courtship of two deer from across a narrow lake where we lay with a powerful telescope. The supple-legged doe browsed along the water's edge and through low thickets. The faithful buck remained some fifteen feet in the rear. When the doe stopped, he would also pause, only to move forward whenever she did. She fed more or less continuously and behaved as though totally unaware of his presence. He enjoyed never so much as a mouthful. In this way they progressed slowly for several hundred yards until the doe stepped behind a particularly dense clump of shrubs and disappeared from the buck's view. Thereupon he rushed to the other side in a flash, as though to reassure himself that the object of his attention had not vanished permanently.

The buck then kept his distance as before and continued to follow, now with an occasional toss of his head, as though becoming impatient at last. Finally they both moved inland beyond our sight. In the more than half

an hour we watched, the doe failed to give her follower the slightest recognition, much less encouragement.

When the mating season is over, in fact during the period from December to March, the bucks loose their handsome antlers and again join the ranks of the undistinguished. Woodmice and other rodents discover the symmetrical tines upon the ground and proceed to chew them to pieces, despite their hardness. Such is the ignoble end of the buck's temporary crown of glory.

New antlers appear in the spring, as small, delicate masses which grow rapidly and soon acquire definite form. They have a soft velvet covering which remains until practically the end of summer. When the antlers are fully developed, the bucks rub them against tree trunks until the now useless outer covering is removed. The miracle of transformation is complete and the animals are ready for any intertribal contest that may come their way.

We shall never cease to marvel at the dexterity displayed by antlered bucks as they dash through heavy underbrush without entangling their spreading horns. Frequently the growth through which they travel is so intertwined that a man would have difficulty keeping his hat on his head while attempting to run after the animals.

One who watches deer over a period of years will witness a great deal that

▼ Whitetails in winter coats approach for a handout, ready for quick retreat



is commonplace in the everyday lives of the animals. Through the law of averages and through good fortune one may also be present during some unusual event. The most exciting experience we have had in connection with deer observation, concerned an adult golden eagle and a half-grown deer with its mother.

The presence of a golden eagle in our Eastern park was a rarity in itself. In many years we have gathered few records of this large bird in our immediate region. Several years previously we had examined one of them that had been accidentally caught and killed in a fox trap, set by a poacher. The unfortunate bird had tried to secure the fox bait, only to have the trap close upon one of its taloned feet.

When we first saw the eagle that chased the deer he was perched upon the limb of a big maple in a broad open field. We stopped our car hoping that he would not fly off before our binoculars were trained on him. We lowered a window cautiously and remained in the car. Then we saw the deer not far off. There was a small doe and her smaller offspring. It was mid-January and there were large patches of snow on the field, with tall clumps of brown grass rising here and there. The deer were standing very still,

making no attempt to feed and paying no attention to us.

Suddenly the eagle, with its broad wings set, sailed out of the tree straight for the deer. It reached them in an instant, half circled some four feet above the younger animal, and then made a dive directly at its head. The startled deer ran forward a few paces and stopped as the eagle returned to its perch. We were certain that the large bird had been within six inches of the deer's head.

Presently the eagle came forth again, and the original incident was repeated, almost detail for detail. The third and last time, as the eagle once more approached on swift pinions, the doe with her young one close by her side, rose to her hind legs and viciously flailed the air with her front feet. This maneuver apparently surprised the eagle, for instead of diving, the big bird executed a complete circle above the belligerent deer, with much flapping of wings, and once more retreated to his perch in the maple.

At this juncture a group of noisy hikers came walking up the road, heedless of everything except themselves. The eagle glided away and the deer moved into the surrounding woods and disappeared. When we walked over to the scene of events, we found no traces of blood or any other sign to indicate that the deer had been injured. For all we know,

the golden eagle may have been having sport, with no deadly intentions whatever. If this were the case, it seemed the deer would prefer some other form of frolic.

The hikers approached to inquire what we were looking for in the field; and when we told them of our experience, there was a quick sympathy expressed for the deer.

We have always found a warm regard for deer among people everywhere. This is easily understood when one considers the grace, beauty of form, and gentleness of the animals. Perhaps an outstanding incident involving man's feeling for the deer was revealed in our park police station one evening when a white-faced motorist rushed in to announce, tremblingly, that his car had just struck and killed a deer.

"Too bad," said the Sergeant in charge. "We have a lot of deer, and sometimes one of the poor things will be blinded by the headlights. Was your car badly damaged?"

The deer slayer answered that his car was a wreck and that he had been forced to leave it in the ditch.

"But," he said, "I was not so much worried about the car as about the deer. I'd have gone off the road willingly to avoid killing one. You see, I had a pet deer when I was a boy."

Deer are like that, and so are people, sometimes.

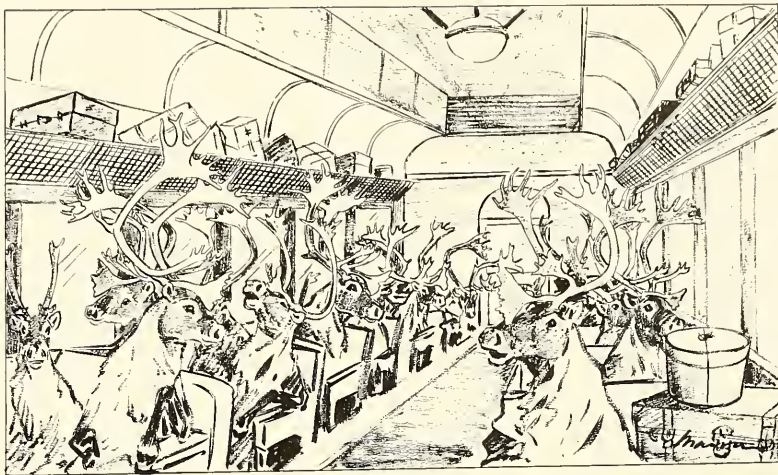
▼ The routine of the nursing bottle is quickly learned, but foster parents must have patience



▲ A whitetailed fawn, several days old, makes a very appealing handful for Trailside Museum visitors



ESSENTIAL TRAVEL



By JOHN ERIC HILL

Drawing by

G. FREDERICK MASON

MIGRATION is common among birds; and eels and butterflies even undertake mass movements that cover great distances. But the mammals that migrate are less famous and are few species out of many.

The change to colder weather finds some of the seals and seal-like mammals swimming from high latitudes to warmer seas, from which they will return in the spring. Some bats are flying long distances to gentler climates. With the first snows, the mule deer and wapiti will move down out of the mountain forests to the lowlands, and the mountain lions will follow the deer, on which they feed.

If we were living in the great unexplored West of earlier days, we would see the bison or American buffalo moving in great herds from the northern plains and prairies southward in the fall, to return like a great brown tide in the spring. But the mammal that today makes the greatest migration is the Barren Ground Caribou.

These large deer make their home on the tundra, north of the limit of tree growth. (Other caribou roam the northern pine and spruce woods and the mountaintops above timber line.) They are social animals, usually living

in herds; and when large migrations are in progress the herds may number millions. Caribou are wanderers, eating as they move along, often covering many miles each day. Large rivers are no barrier to them. Caribou swim well, floating high in the water and striking out with their large hoofs.

One of the conspicuous things about caribou migration is its irregularity. Northern Indians and Eskimos, who depend largely on the herds for meat, know this to their sorrow. Some years great droves, hundreds of thousands strong, come through. In other years only small bunches go by. The routes of the migration may shift many miles, leaving only a few stragglers to follow the old route southward. The date also changes. The herds may begin to move from the summer pastures as early as July, but usually the journey begins after the rut in late September and October. During some migrations the animals move rapidly, occasionally trotting, while in other seasons the caribou move leisurely, feeding as they go and basking in the sun for hours. The general direction of the migration is southward, but some herds travel due east or due west, in different parts of Alaska, for instance.

Why should caribou migrate? It is not because of the weather. Few animals have a more weatherproof coat. During the summer the hair of the new coat begins to grow. At first it is fine and soft; but as the hairs grow, they thicken and become more pithy.

By late fall the coat is dense. The hairs stand almost straight out from the skin, and in between the coarse, air-filled hairs are fine wool hairs. The usual arctic temperatures do not bother such well-clothed mammals. Shelter does not seem to be important to the caribou. Many herds spend the winter in bare, exposed areas. On many arctic islands and in Greenland the animals cannot migrate far enough to make any difference in conditions.

Hormones—internal secretions that influence behavior—are thought to govern the migrations of some animals. In the caribou, there may be some relation of this sort, but it is not very obvious. The most evident physiological changes in caribou seem to occur before or after migration.

Probably the caribou's chief reason for traveling seasonally is food. During the summer, grass and the leaves of shrubs are the main food. The first frosts make these unattractive. In winter, the staple diet of caribou is lichens—lowly plants that in our latitudes grow mostly on rocks. They are very slow-growing. A few animals can remain on the summer range without exhausting them, but if the herd were to stay there, the lichens would be eaten to the roots. In the long run, both the pasture and the caribou are preserved by the habit of migration. So, to use the current phrase, the caribou migration, which is now going on, can be called "essential travel."



"Natural History"

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COLOR PROCESS, BLACK AND WHITE, BEN DAY, LINE

Above Illustration: Part of Plains Group, American Museum of Natural History. Photo by T. L. Bierwert and C. H. Coles



THE STINGLESS BEES

Continued from page 417

are probably rival colonies of their own kind. The literature abounds with instances where one colony has engaged in mortal combat with another. It has even been claimed that certain stingless bees poorly equipped by nature for pollen-gathering live solely by assault and robbery. In addition to being attacked by insect enemies, stingless bees are preyed upon by various mammals, reptiles, and birds. A jumping spider sometimes stations itself near the nest entrance and makes its leap on a foraging bee before the bee has a chance to disappear into the interior of the hive. Altogether the life of the stingless bee has its intranquil moments.

Not only are there combats between rival colonies, there is also a purge from time to time of certain members of a given colony by the workers of that colony. The victims in this case are the males, and their forcible ejection from the nest and mutilation would seem to be modeled on what in honeybee colonies is known as the slaughter of the drones. This ruthless treatment seems meaningless and fundamentally opposed to the interests of the hive if credence is given to the oft-repeated claim that the male stingless bee, in contrast to all other male bees, performs services of significance to the species other than those of fertilizing the female. If, indeed, the male stingless bee produces wax and aids in nest construction, as has been asserted, such unprecedented activities on the part of this individual would constitute the greatest paradox of all of those associated with these paradoxical insects.

Even those who attribute useful faculties to the male stingless bee do not go so far, however, as to claim that he is a honey-producer and pollen-gatherer, or even that he goes forth in search of building material to supplement the wax which, like the worker, he is alleged to produce from between the dorsal segments of his abdomen. For the colony of the stingless bee is not exclusively a city of wax. Other materials in addition to wax constitute its building blocks—resinous substances, earth and clay, excrement, plant particles and plant exudates, tar, grease, oil, varnish, bits of wood, and doubtless other things. Foraging for these is the function of the worker bee, and upon her rests the responsibility, too, of keeping the larder supplied.

Flowers, on the whole, are the principal source of food, furnishing nectar and pollen, the essentials of life for the bee. But they are not the only supply base of nutriment. Some species of stingless bees—possibly many more than we suspect—are fond of the sugary secretions of Membracids or Insect Brownies as they have been called. The carcasses of animals are frequented by certain stingless bees for their juices, and these bees have even been observed nipping off the flesh in tiny morsels. "Moist bread," "old stinking cheese," and the like are among the things apparently attractive to these perverted epicures, in addition to foods of more understandable interest like honey (even if of alien manufacture), the juice of fruits, sugar cane and sugar products, jam, and just plain water. Some of the putrid sources of supply, such as the moist malodorous contents of garbage cans, give one pause in accepting indiscriminately the honey of certain species. It is also true that while the product of some stingless bees has a high reputation for excellence, that of others is tasteless or disagreeable. Certain stingless bees—notably *Lestrimelitta limão*—even produce a honey of toxic nature that frequently induces nausea and other unpleasant symptoms.

So perhaps, after all, in spite of the debt that the pre-Columbian Indians of the American tropics owed to the stingless bees, it is not altogether to be deplored that other supplies of sweets have been made available from the Old World. Nevertheless, although their products may be replaced, the stingless bees and the many puzzling problems of biology that they pose will always be a zestful source of interest for the melittologist. Limits of space have prevented discussion of many of these problems, but one more should be mentioned. Though legitimately belonging to the bees classed as social because they live in colonies, stingless bees feed their young after the manner of the solitary bees. All of the supplies required for the complete development of the larva are packed into the brood-cell at one time. Hence there is no contact ordinarily between the adult workers and the bee babies. This unsocial manifestation in a social bee—doubtless a survival from the past—is yet another and in some respects the most remarkable way in which the stingless bees flout preconceived notions as to what should be the orthodox behavior of a bee.

rivers and through the Arctic Ocean. The reader shares with the author zest for this great, successful experiment and sympathy for the enthusiasms and tribulations of the very human people who are participating in it. The significance is emphasized by an account of the voyage of the ship "Anadyr" through the northeast passage, from Vladivostok to Murmansk, in one summer.

Although an outstandingly good reporter of her personal experiences, the author is not adequate or dispassionate in many of her generalizations. Her reporting is also insistently feminist, though it often verges on the merely feminine and sometimes becomes downright school-girlish.

First published in 1939, the book has been revised, with added summaries of the little that is known of developments in Siberia during the war and of recent Russian flights between the Soviet Union, Alaska, and the United States.

G. G. SIMPSON.

GLOBAL EPIDEMIOLOGY

- by Simmons, Wayne, Anderson, and Horack

J. B. Lippincott Company, \$7.00

504 pages, 14 maps

INTEREST in Pacific and Oriental places that were unknown to most of us a few years ago has been greatly stimulated by the war, and whenever a new name appears in the news we naturally wonder what the place is like. We would like to know something about its topography, its people, and the conditions under which they live. The answer is in this book.

Although Guam has been an American possession for 46 years, most Americans know only that it was a naval base on the far side of the Pacific. Guam is a volcanic, mountainous island and in 1939 had a population of 22,800, of which 21,000 were native Chamorros. An extremely poisonous sea snake occurs in the shallow waters around the island, and there are a number of different kinds of poisonous and dangerous fish. There is no malaria on the island; but mosquitoes, flies, rats, scorpions, and centipedes are numerous. Although naval reports stressed the need of additional medical personnel, the care of the population was considered quite satisfactory. While the water supply is ample, most water is considered to be unsafe without treatment. All diseases known to occur on this and adjacent islands are discussed.

The above is just a small smattering of information about Guam. There is much more; and all the island groups, as well as the countries bordering on the Pacific, are treated in a similar manner.

Explorers and travelers, after the war, will find this book of the greatest value, for, even though conditions may have changed somewhat as a result of Japanese occupation, the basic conditions remain the same. It is an invaluable guide to medical men. Its style is such that the

layman will enjoy it, too, and anyone contemplating a visit to the Pacific or Far East will do well to consult it.

C. H. CURRAN.

AQUATIC PLANTS OF THE UNITED STATES

----- by W. C. Muenscher

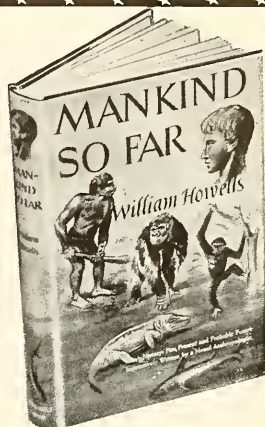
Comstock Publishing Co., \$5.00

384 pages, 157 illustrated plates, 400 maps

THIRTY years of work on aquatic plants have carried Doctor Muenscher through all the States. A few years ago it was nearly impossible even for an expert to identify the more complex groups; now, thanks to his exhaustive work, the amateur should be able to do so.

The fisherman is familiar with many aquatic plants, though he is sometimes inclined to lump all the submerged forms under the general name of "grass." He may know that there are white water lilies and also yellow ones, which he calls "cow lily" or "spatterdock." He would not ordinarily know that there are six different yellow and four white lilies in this country. Far down in the water he sees the fan-shaped basal leaves of the northern spatterdocks and the ascending streamers of pond weeds, whose floating leaves and flowering spikes may be examined in the shallower coves.

With an illustration and distribution map for nearly every species, identification is relatively simple, and adequate bibliographic references lead to further information. Short descriptions distinguish the families and genera, and species are differentiated by keys. Lists tell us which ones propagate by rhizomes, runners, winter buds, etc., which together with the various seeds are of great importance in the food of aquatic birds. The problem of storage and treatment of seeds



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is discussed, and a table shows the relative weights of seeds. One of the yellow bladderworts (*Utricularia cornata*) leads with approximately 175 million seeds to the pound. At the other extreme is the water chestnut (*Trapa*), now a nuisance in the Potomac and Mohawk Rivers, with only 75 green seeds to a pound.

The thanks of all who are interested in the wildlife of our lakes, swamps, and tidal marshes are due to Doctor Muenschner for this delightful book, which represents Volume Four of a series of Handbooks of Natural History.

H. K. SVENSON.

ENTOMOLOGY FOR INTRODUCTORY COURSES

----- by Robert Matheson

Comstock Publishing Co., \$5.50
600 pages, 500 illustrations

THERE has long been need of a book on insects that will fill the gap between the "popular" books and the strictly scientific ones. Doctor Matheson has produced just this kind of book, and now the beginner, who has had his interest in insects stimulated by works such as *The Field Book of Insects* by Lutz, will be able to continue his studies without encountering too many scientific terms.

The whole field of entomology is covered in an interesting way. Beginning with the broad aspects of biology and continuing with the development of insects and their relatives, one comes to the structure of insects and the way they grow, and to a discussion of the various orders and the important families. In this latter section the reader will discover many of the amazing things about insects. He will find a fly that broods its eggs, usually remaining with them until she dies; wasps that swim under water in search of bug eggs; and other equally remarkable habits.

The relationship of insects to human welfare is amply covered in the final four chapters, which discuss the benefits derived from insects as well as the harm they do to man, his crops, and his livestock.

Of the many works on general entomology that have been published during recent years this must rank with the best.

C. H. CURRAN.

AMERICAN BOTANY 1873-1892:

Decades of Transition

- - by Andrew Denny Rodgers III

Princeton University Press, \$3.75
340 pages, 3 illustrations

THIS is the fourth volume by Mr. Rodgers in the series on the history of American botany, the preceding ones being *John Torrey, A Story of North American Botany*; *'Noble Fellows', William Starling Sullivan*; and *John Merle Coulter, Missionary of Science*. An immense amount of research has gone into the

making of these books, which contain the story from the beginning down to the present generation of botanists. Besides those whose names are mentioned in the titles of the preceding volumes, we have the account of the work of all the leading American botanists: Gray, Tuckerman, Lesquereux, Engelmann, Bessey, Farlow, Barnes, and many others.

The volume here considered does not deal with the real pioneers but with those active during the years indicated, chief among them Asa Gray. This great period of North American botany (1873-1892), dominated by one man—Gray—and his associates, produced some of the ablest botanists this continent has known. It is with the work of those botanists who drew their inspiration from Gray that the author has dealt in this volume. Interesting chapters are devoted to Government Surveys and other western explorations; to botanical explorations in Canada, our southeastern states, and Mexico; to the development of paleobotany; to experimental laboratories for teaching and research; to the rise of agricultural experiment stations; and to other matters of historical interest.

The author's familiarity with the botanical literature and his evident grasp of the fundamentals of the science fit him well for a task of this kind. At the same time, he has the happy faculty of telling a very human story.

CLYDE FISHER.

GUIDE TO HIGHER AQUARIUM ANIMALS

----- by Edward T. Boardman

The Cranbrook Press, \$2.00
107 pages, 58 illustrations

MANy people are aware of the wide variety of exotic fishes that are admirably suited for home and schoolroom aquaria, but few realize that there are a number of equally interesting local aquatic animals that can be housed without undue difficulties in the living-room tank. Doctor Boardman has chosen for discussion 59 representative fishes, frogs, toads, salamanders, snakes, and turtles that adjust readily to conditions of captivity and can be collected by the amateur naturalist. For each animal selected there is an excellent photograph, followed by a brief account of its appearance, habitat, breeding habits, and food preferences. Although focused on the fauna of Michigan, a considerable part of the information can be applied to the same or related species in other parts of the country. In four appendices are found recommendations for treating diseased animals, a discussion of aquarium water, a list of hardy tropical fishes, and the advice that the beginner might do better to start with some of these tried and tested varieties.

The author stresses the importance of feeding most of the captive animals with live food, even though it may be difficult to obtain during the winter months. The possibilities of substitute foods are passed over lightly, although recent investigations have shown that beef, liver, fish, cereals, etc., sometimes equal or surpass live food diets. Thus, while the reader

is warned of the possible difficulty of finding sufficient food for the voracious bullfrog, the well-known trick of placing a cube of beef on the end of a stick and waving it slowly in front of the frog until it is snapped up is not mentioned, even though bullfrogs can be maintained in captivity for years with this technique. Despite this shortcoming, the reviewer recommends this book highly to those amateur naturalists and teachers of biology who like to "bring 'em back alive."

L. R. ARONSON.

THE WOODS HOLE MARINE BIOLOGICAL LABORATORY

----- by Frank R. Lillie

University of Chicago Press, \$4.00
284 pages, illustrated

THIS book is likely to have no wide appeal to the general public. As an educational document, however, it is of high importance, and to all who have been reared in the biological tradition it is likely to prove utterly fascinating on many counts. Woods Hole stands as a distinctly original experiment in learning, namely an institution for scientific research, supplemented by instruction, which has always been owned and conducted exclusively by scientific workers. Its freedom and success since 1888 have been marked by an almost unequalled financial economy and by the effective co-operation of representatives from about a thousand educational institutions in the United States and abroad.

The author, Professor Frank R. Lillie, and his collaborator, Professor E. G. Conklin, have enjoyed, respectively, 43 and 46 years' association with Woods Hole. The book deals with the antecedents and founding of the famous laboratory, making clear the tie with the earlier experiment of Louis Agassiz at Penikese and with the summer school at Annisquam which was supported by the Woman's Education Association of Boston. It is illuminating, incidentally, to learn what an important part women have had in the beginnings and continuance of the work at Woods Hole.

Five chapters deal with the material growth, the policies, administration, difficulties and crises, the trend of research, the personalities of four inspiring leaders, and the delightful community life at Woods Hole. A final chapter describes a younger and closely affiliated laboratory, the Woods Hole Oceanographic Institution. Seventy-five pages of appendix matter support the prior text with many sorts of detailed information—historical, personal, and financial.

The comprehensive picture presented is a remarkably happy one, and it also bodes well for a glorious future at Woods Hole. In hunting for something to criticize in this book, the reviewer can only regret that nearly half a century of part-time residence at tide-water has not prevented Professor Lillie from stating that the oceanographic ketch, "Atlantis," attains an engine speed of "9 knots per hour."

R. C. M.

Living Room ZOO

By THANE L. BIERWERT

*Acting Chief, Division of Photography
The American Museum of Natural History*

IF a certain fuzzy, yellow caterpillar had not gone trackwalking one late summer day, I would not be writing about the good fun that a home menagerie can give a photo-naturalist. One of our boys rescued that caterpillar and carried it 260 miles home. Nearly every youngster comes back from summer vacation with a live animal of some sort, be it furry field mouse, cool snake, wet frog, salamander, fish, or turtle. Of course, we parents can object, but is that being educational? When the outdoor season is interrupted, a home menagerie permits your photographic hobby to continue through the winter months.

There are two ways to photograph "small game." The easy method is to plunk the animal on a cardboard or other smooth surface, herd it into position, and make the exposure. The result is a good likeness, but it lacks realism and interest. The other method is to build a background similar to the one in which the animal once lived. You will spend more time on each picture, but the reward will be two-fold. You will have a truer and more colorful depiction of the creature and a better understanding of where and how it lives.

This latter method is comparatively simple when once you have learned to set the stage. Select an ordinary home aquarium about fifteen or eighteen inches long, eight inches deep, and ten inches high. One with narrow corner supports and a very narrow top rim, or, better yet, no rim at all, is preferable, because the slight framework will minimize the shadows cast when the setup is illuminated.

If there is a metal rim around the top, use it to support a vertical sheet of glass for keeping the specimens at the proper focal distance from the camera. File two sets of slots on the side rims, two and four inches from the front glass, thus providing a compartment that can be shifted to suit the specimen or the habitat.

A baby painted turtle is a tough and patient model to use as a beginning. You will want to create a small pond to demonstrate that the turtle lives both above and below water. Wash some smooth sand, enough to cover the bottom of the aquarium one or two inches deep. Ask your son or daughter to visit a near-by stream or pool and bring home several rough, weathered stones that have the flat, irregular surface on which a turtle would like to sun himself. Build a "sunning" spot about six inches high near one end of the aquarium. Very gently pour in enough water to bring the level even with the top of the stones.

Now you are ready for "atmosphere" in the form of plant life. If there is a pond near by, collect el-grass or chara; if not, visit the local pet shop and buy some water weeds. Tie them into small groups and weight the stem ends with flat pebbles. Plant the tall weeds in the

rear to form a natural background, the short ones in the foreground to break the expanse of sand and to blend stones and sand. But do not let the greenery hide the turtle. Place a few household plants behind the aquarium. These, being well out of focus, will give greater distance, filling in the dark blank area above the water line.

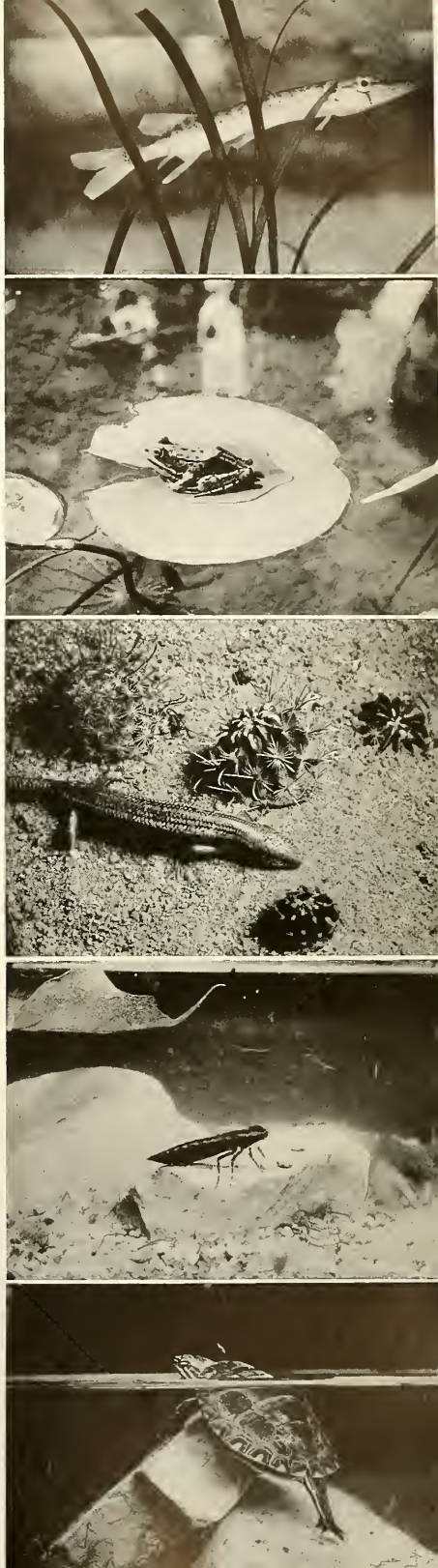
With the stage all set, the star performer might as well become acquainted with his surroundings while you arrange camera and illumination, so turn your turtle loose.

The best camera location is at the water level, because the turtle will be near or breaking through the water line. Above or below that point, the mirror effect of the water surface may prove annoying. If you have a ground glass camera, the problem of including exactly what you want in the picture will be simple. Remember to compensate for bellows extension when calculating exposures for close-ups of this sort. If you use a regular roll film camera, select a Portra lens No. 3 with working distance of 13¾ inches. There are several advantages to this choice. First, it gives you a good-size image on your negative. Second, with this front lens, the camera will not take in the rear supports of the fifteen-inch aquarium. And third,—an advantage over the ground glass camera,—no additional exposure is needed.

Very accurately measure the distance from the lens to the spot where the turtle should sit for his portrait. You are now ready to light your stage. The most convenient illumination is sunlight. Photo floods are the next best. The most expensive are flashbulbs, but they are the only illumination to use to stop rapid movers. Arrange the main lamp or lamps to throw the light from above and from near the front. Create shadows, and then fill them in with secondary, weaker illumination. If you use three or more bulbs, do not leave them on too long. The writer once heated the water to a point where he almost had boiled crayfish! The stronger the light, the smaller the lens aperture and the more rapid shutter speed you can use, both of which are an advantage in this sort of photography. Should you prefer to use flashbulbs, replace them with ordinary bulbs while arranging the illumination. Exposure guides are available for computing exposure with flashbulbs.

When placing your lamps, be sure that a reflection does not bounce back from the front glass into your lens. The only remedy is to move the lamp. And if the chromium surfaces of your camera are reflected in the same way, cover the camera with some dark, soft material. The exposure meter should be held close to the front or the top of the aquarium but not in a position where it will receive reflections from the lamps on the glass or water surface.

After the stage, camera, and illumination are set, gently guide the turtle into position. If he moves around too much,



cool the water, either by changing it or by adding a few ice cubes. When he strikes a good pose, shoot.

The setup for the painted turtle, from habitat to exposure, can be used as the foundation on which all other small animal photography can be based. The same aquarium can readily be used for water creatures—fish, water newts, crayfish, snails, and insect nymphs. The camera can be tilted down slightly to show more of the sandy bottom, because most of these animals will “sit” lower than the water line.

When arranging a habitat for land

creatures, such as lizards, salamanders, snakes, beetles, and toads, compose the ground work on the bottom of the aquarium for your foreground and build a background of club mosses, small evergreens, or other appropriate plants. As in the case of the turtle, always arrange your camera and lamps in a way that presents your specimens most naturally. Be sure the glass is clean.

The remarkable feature about this hunting is that you can mount your trophies on the wall and still have them alive in your private zoo. Once you start, there is no end to the possibilities.

THE COAST OF WINTER DROUGHT

Continued from page 406

latter creatures we saw nothing, but from time to time we heard them clatter off through the ground cover. Pedro told us that Chocó Indians sometimes came from great distances up and down the coast to hunt iguanas on these *morros*.

“Do they have guns?” I asked.

“No Señor,” replied Pedro, “they kill them only with bows and arrows.”

This seemed an unlikely tale, and I suspected Pedro of attempting to pull our legs. But about the middle of the day, while the three of us were sitting in the shade just above the wave-worn platform, waiting for “Askoy” to come back from her dredging and take us off, Correia idly picked up a stick from the forest floor and was at once struck by its weight. It was an arrow-shaft made of chonta palm, notched at one end for the iron point.

Before sailing on our oceanographic voyage across the mouth of the Gulf of Panama, we arranged with Pedro to conduct Correia on a trip into the mountains. Our collector took only three pieces of luggage, namely his specimen-drying case, a duffle bag, and a box of food. We supplied him with rice, tea, and sugar from the schooner’s

stores and bought him yams, limes, and tinned fish ashore. The supposition was that meat from birds and mammals, and additional fruit, would always be available. The bargaining was made very precisely. Pedro González was to receive a dollar a day and his food. The two canoeists and carriers, who were merely to come and go twice, were each to have \$1.50 for the two journeys, and the use of a *cayuco* for river travel was to be one dollar for the round trip.

After various last-minute errands on February 25, Correia and his outfit went aboard the *cayuco*, and the three Negroes poled rapidly upstream. Each had brought a machete, and Pedro allowed himself the extra luxury of a plate and spoon; such was the total equipment, except for what Correia carried. The three men had been wearing clean white shirts and trousers when they kept their appointment with us on the beach, but just before departure for the wilderness they dashed into their huts and arrayed themselves in extremely dirty and abbreviated rags.

It was after dark on March 1 before we returned from an exhausting cruise and kept our rendezvous with Correia by flashlight signals between ship and shore. Then Armstrong and I maneuvered the skiff through the surf

and fetched him on board. He was weary, as we were, but happily no less successful. He was full of stories of Chocó Indians and the up-country, deeply impressed by the enormous height of the mountain trees in which no gun could reach birds among the upper boughs, and still more by the nearly perpendicular steepness of the ranges north of Piñas Bay, where hands as well as feet were needed in climbing. The Indians had told him that nobody lived near the crest of the mountains but that twice a year, in the right seasons, the young men organized peccary hunts that took them to the highest peaks. Correia himself had not reached altitudes above the tropical zone, but his collection, nevertheless, contained birds of great interest.

He grumbled a bit over the fact that his black men had proved “first-class eaters.” Pedro was so entranced by the simple fare taken along, including the tins of Japanese sardines purchased at the Santa Dorotea store, that he would get up two or three times in the night in order to stuff further. Correia was at least relieved that only one helper had remained with him!

There were mosquitoes at one or more of the Indian huts in which the two men had camped among the mountains, and Correia had cut and sewn himself an insect-bar from the netting which I had insisted that he take in his duffle bag. Now, although Pedro González had probably never before even seen mosquito netting, he had demanded that he also must have the same protection over his hammock. When I settled our bill with Pedro I found the worthy guide somewhat *hors de combat*, wearing very filthy bandages around the great toe of his right foot and the second toe of his left. It seemed that after returning with a whole skin from the highland wilds, where not only mosquitoes but also jaguars, venomous snakes, and man-chasing white-lipped peccaries are said to abound, Pedro had been attacked in the peaceful dark of his own hut by vampire bats, which had let plenty of his blood. He appeared no more than mildly concerned, although it is now known that the bites of these tropical American blood-lappers are capable of transmitting trypanosome parasites and the virus of paralytic rabies, either of which is capable of proving fatal, at least to horses and cattle. (To be continued)



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THE CAMEL BRIGADE

Continued from page 397

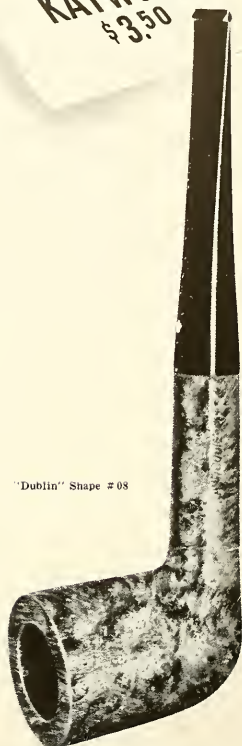
were landed in Texas. Quality rather than quantity governed the choice of animals, and prices paid ranged from a low of \$100 to a high of \$400. To instruct Wagon and Forage Masters of the U. S. Army in camel lore, 15 Arabs and Turks were employed at \$15 a month each. Among this group, according to Porter, was a "camel M. D."

Lieutenant Porter was a seaman, accustomed to direct action and plain speech. When on the second voyage the Viceroy of Egypt promised a gift of six fine animals, Porter expected to receive just that. There was some delay attending their delivery and when Porter saw six scrubby, mangy beasts, he would have nothing to do with them and so informed the Viceroy. It was not the sort of gift His Excellency had intended to offer the United States and he quickly corrected the nefarious dealings of a subordinate.

The confinement of an ocean voyage is a hardship for livestock, and it was particularly difficult for animals as top-heavy as camels. When seas roughened, Porter had the animals brought to their knees; when the rolling increased he designed a harness to hold the kneeling animals. When the wind moderated and the camels were unable to rise, he saw to it that the stiffness was massaged from their legs. The booghdee, a gigantic brute, presented a special problem due to its height, but Porter cut a hole in the upper deck to accommodate its hump. During rough weather the native attendants were too seasick to be of use, and in calm their services were rarely required.

The captain of the *Supply* was a newcomer in the camel experiment, but he was an intelligent man and applied common sense to a new circumstance. He formulated sensible rules governing the camel deck and made certain that his orders were obeyed. The veterinary practice of the "camel M. D." was a compound of ignorance, cruelty, and superstition. When the first calf born aboard the *Supply* died under his ministrations, Porter successfully applied horse sense at the next delivery. He had little confidence in the efficacy of tickling a camel's nose with a chameleon's tail, a treatment recommended for obscure ailments.

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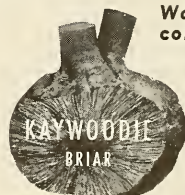


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Among the Bactrians and Arabians aboard the *Supply*, there were four *pehlevans*—trained wrestling camels. In their native state, male camels defend their harem from interlopers by throwing a right foreleg across the neck of an opponent and bearing him to the ground. A buck camel thus vanquished either sought companionship elsewhere, or the combat was carried to a bloodier finish. This natural wrestling tendency had been cultivated by the Arabs, and camel wrestling matches were as common in the Levant as cock-fights in Alabama. By the time a calf, christened "Uncle Sam," was a month old, the Arab tenders had coached the youngster into a first class wrestler. It had been born on the *Supply* and seemed to possess sea legs at birth. It was eager to wrestle any other animal similarly equipped. The calf had the run of the ship, and it stalked unsuspecting seamen as they performed their tasks. With the advantage of surprise, the infant *pehlevan* invariably won the first fall in innumerable wrestling matches in a matter of seconds. There is no record of its having thrown Lieutenant Porter for a loss, but by order of the captain of the *Supply* the budding champion was securely tied.

The Texas coast had been selected for debarkation, for it was thought that the Southwest most nearly approximated the environment to which the camels were accustomed. At Indianola the importations were allowed time in which to regain land legs. Major Wayne selected Val Verde (Camp Verde of the War Department Reports), about 50 miles from San Antonio, as a permanent home for the newcomers, and there they were settled to rest and recuperate from the voyage. Jefferson Davis pointed out that months were required for horses to recover from a long voyage; since camels were larger they would require even more time.

The camels were incomprehensible to Texans. Sudden sight of the plodding apparitions scared a number of hardy frontiersmen witless. To the normal beasts of burden of the region they were completely unacceptable, and a brief glimpse of the camels was sufficient to spur a sleepy burro or a lethargic mule into astonished activity. Startled men and mules regarded the experiment with scant sympathy, but men engaged in the freighting of goods were much impressed when they saw a camel lift 1200 pounds (a load that

would have flattened a mule) and leisurely plod away with it.

The camels remained at Camp Verde for some time; and the experiment, according to the War Department, "proceeded according to plan." The animals received exemplary care and were allowed to stretch their muscles on several easy round-trips to San Antonio. They became a familiar sight in the country, but since they had neither horns nor hoofs they were not regarded with favor by inhabitants of a country overrun with both.

The 1850's were a period of westward migration, and the camels were indirectly to influence this restless surge toward the Pacific. Emigrants who made the overland journey left civilization behind at Independence, Kansas. Crossing the Kansas River, they topped the divide to the north to strike the Platte in the vicinity of Grand Island. The valley of the Platte and its northern fork offered a broad but primitive highway that led to the Sweetwater. And from the head of that stream the emigrants toiled upward to cross the backbone of the continent at South Pass through the Wind River Range. By then they knew that a hard road lay behind them, but few were aware that the road from there to California or Oregon was infinitely worse. There was no royal road to the West, and the annual flood of wagons toiled along the only trail they knew.

The southern route to California—out the Santa Fe Trail, across New Mexico, Arizona, and Southern California—saw few emigrant trains, for it was a passage reported to be deficient in water, wood, and grass. Lacking any one of these, a caravan could have little hope for a successful journey.

In the autumn of 1857, Lieutenant E. F. Beale, then head of the California-Nevada Department of Indian Affairs, was employed by the War Department to open a wagon road from the region of Ft. Defiance in New Mexico Territory to the Colorado River. It was intended to be a road feasible for loaded emigrant wagons, with water holes located a day's journey apart and with adequate firewood and forage for stock. The firewood was a necessity, because in the Southwest buffalo chips were rare.

In September 1875 the brigade of camels, mules, and a few wagons left Camp Verde, Texas, for Albuquerque, New Mexico Territory. Months of rest and sensible care had prepared

the camels for the journey; time alone would corroborate the distrust of their critics or justify the optimistic claims of their proponents. At the outset, the camels lagged behind the mules and wagons, but very soon their muscles were accustomed to the work, and from then on they required so little attention that their placid efficiency was taken for granted.

From Camp Verde westward to the Rio Grande and then northward along the Santa Fe-Chihuahua Trail which lay in the valley of that stream, the caravan was a source of wonder and amazement in each small settlement. Very probably they stampeded horses, mules, burros, and oxen encountered along the route, and this would not have increased their popularity.

At Albuquerque the brigade turned westward again, leaving the beaten trail that had carried the commerce of the prairies from Independence, Kansas, to Santa Fe and on southward to the settlements of Mexico. They passed El Morro (Inscription Rock) where M. H. Stacey, a member of the party, carved his name in the soft sandstone not far from where an inscription had been left by Juan de Oñate in 1605.

On to Zuñi and into what is now Arizona the caravan traveled without incident. The modern road that connects Winslow, Flagstaff, Williams, and Kingman is not far from the actual route traversed by the camel brigade, and very probably the animals passed within sight of the location of these cities of the future.

No doubt they were an odd spectacle to the Indians of the region. They were new to the Southwest, but they were not the first of their kind to reach the Western Hemisphere. In 1701 a shipload of camels had arrived in Virginia, but their eventual fate remains unrecorded. And even earlier, camels had been imported to Peru by Juan de Reineza. Some of these escaped and ranged wild near the foot of the Andes, where they were reported by José Acosta, a Spanish missionary, who saw them near the end of the sixteenth century.

The patient immigrants from the Levant that plodded across the Southwest were new to the region but they were not new to desert emergencies. Each camel carried 600 pounds of provisions for men and mules. While the long-eared ingrates consumed their rations without thanks, the camels foraged for themselves and fattened

on thorny desert shrubs. In the malevolent terrain of western Arizona the guides lost their way and led the party far from water. Under a broiling sun the situation quickly became acute. Men who had hoarded the last few gallons of water gave it to the horses so that the animals might not collapse and leave their riders afoot in the desert. The camels met the emergency with their traditional scorn of distance and drought. They laid aside their burdens of food and placidly packed water from the last waterhole, a journey far beyond the strength of their long-eared associates.

Lieutenant Beale, in charge of the expedition, was a man of considerable frontier experience, and for the most part the caravan traveled without harassing delays. The route traversed territory of hostile Indians; but the size of the party, together with unremitting vigilance, prevented surprise. Beale, returning alone one night from a search for water, halted on a rise overlooking what appeared to him a sleeping camp. It was an affront to his specific orders and with the intention of teaching a lesson he drew his pistol, fired it, and loosed a nerve-ripping war whoop. Before he had closed his mouth the reaction was instantaneous and unexpected. A volley of shots from vigilant camp guards ripped the air about him. His horse wheeled to race through the dark night in uncontrollable terror. Miles from camp, still fleeing in panic, the horse stumbled and threw its rider. It was not until the following day that a searching party located Beale, who had spent an uncomfortable night recovering from the jolt.

The men of the camel brigade logically expected that animals accustomed to the waterless desert would prove difficult at the crossing of the Colorado River. The first camel justified their apprehension by refusing to swim the muddy stream. But another was of sterner stuff. Promoted to the head of the train, it took to water without hesitation. The remainder followed in groups of five, like so many ducks.

The camels left the Colorado a short distance above the point where the California-Nevada boundary intersects the River and with their less versatile associates marched across the Mojave Desert. From Val Verde, Texas, across New Mexico, through Arizona to Fort Tejon (near Bakersfield) California, and back to New

Mexico the patient, placid, and efficient ships of the desert carried a heavy load for more than 4000 miles. In his report to the War Department, Lieutenant Beale rendered homage where homage was due and reckoned the value of one camel in the Southwest as equal to that of four mules.

The success of the camel brigade encouraged private capital, and in 1860 the California-Nevada Camel Company imported fifteen Bactrians from Mongolia. In 1862 they landed 22 more at San Francisco. Twelve of these performed efficiently in packing salt from a marsh in Esmerelda County to a silver mill at Washoe, Nevada. Others were employed in freighting supplies in British Columbia. Later, some of the Nevada camels served as ore-packers in Arizona. In most instances the camels performed well, but their incredible endurance encouraged neglect rather than care. Inevitably they were reduced in strength through abuse, and eventually, either because of poor performance or changed circumstances, they were discarded. A few escaped to happy freedom in the desert, and in the 1890's the United States-Mexican Boundary Commission reported that wild camels were frequently seen along the line of the survey. The strays might have thrived and multiplied in the Southwest, just as imported camels have thrived in the Australian desert, but the hand and gun of every man was against them.

Use of camels by the War Department might have continued with even greater success, for the first venture had proved their utility beyond a doubt, but when Jefferson Davis relinquished the post of Secretary of War the experiment lost its most influential supporter. Lieutenant Beale agitated for continued and expanding employment of camels on the difficult trails of the West, but his recommendations fell on ears attuned to nearer voices. He successfully employed a portion of the camel herd in later explorations and volunteered to care for and maintain the balance in return for their services, but the offer was ignored. Stationed at various posts in the Southwest, presumably under the command of officers who preferred mules as pack animals or regarded Levantine innovations with disfavor, the neglected camels fell on ill times. Before their genuine usefulness could come to the attention of another influential proponent, the Civil

War put an end to the experiment.

In Texas the Confederates ignored the camels at Camp Verde; and three strayed into Arkansas where they were recovered by Union forces and sold at public auction in Iowa in 1863. In 1864, 34 Government camels were sold at Benecia, California, and in 1866, 44 at Camp Verde were sold to a Colonel Coopwood at \$31 a head. Some of these were removed to Mexico and some, according to reports, were resold to circuses.

The ultimate fate of most of the camels, which had so thoroughly justified the hopes of Davis, Wayne, Porter, and Beale, is hidden in obscurity. Only one remained indefinitely in Government service—its mounted skeleton stands in the National Museum in Washington, an exhibit for the enlightenment of this and future generations.

History is more generous with some of the men associated with the venture. Jefferson Davis was destined to be the leading figure in another but more tragic experiment, for he became President of the Confederacy. The common sense of Lieutenant Porter eventually won for him the rank of Admiral, and his namesake the U.S.S. *Porter*, a destroyer, was sunk only two years ago by an aerial torpedo while on an errand of mercy rescuing seamen from a sunken ship in the Battle of Santa Cruz Islands. Lieutenant Beale's honors included those of a Brigadier-General and the office of Minister to Austria-Hungary. Young M. H. Stacey left his name engraved on El Morro where, together with the names of other noteworthy westbound emigrants, it adds to the historic interest of a National Monument.

Of all the individuals who cared for the camels, probably none achieved mention in so many personal histories as did Hadji Ali. Beginning in the Mediterranean under Wayne and Porter, he remained in faithful service until 1870. Mustered out, he became a prospector and for years was a colorful figure in the Southwest. In a new land this son of the East was more fortunate in winning friends and influencing people than the camels he tended. Hadji Ali may have remained a Levantine at heart but not in name. He appears briefly and favorably in the memoirs of many pioneers who left written accounts of their adventures in the Southwest, and always as "Hi Jolly."



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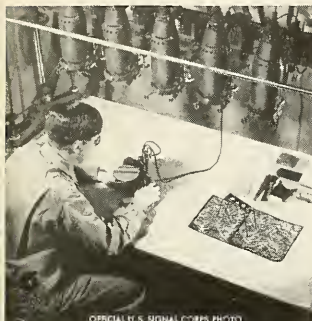
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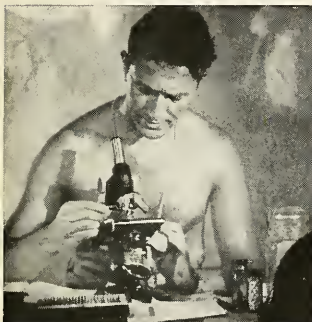
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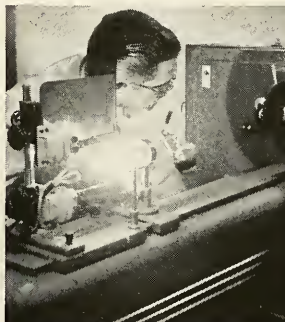
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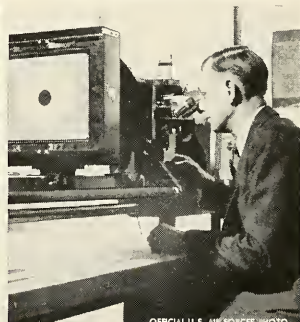
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December **NATURAL HISTORY** 1944

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LETTERS

SIRS:

Your article "The Camel Brigade" in the November number was most interesting, particularly the item on page 433: "In 1864, 34 Government camels were sold at Benicia, Calif."

These animals arrived at the U. S. Arsenal, Benicia, which is about 30 miles north of San Francisco on the upper reaches of the Bay at the mouth of the great Sacramento and San Joaquin Rivers. As a boy of ten I remember their arrival, and how excited we all were to go to the corral and sit on the fence and watch these great beasts with their rough and shaggy coats contentedly chewing their cud.

They were all sold off to circuses and were all gone by about 1870 or 1871.

M. HALL McALLISTER,
Redlands, California

SIRS:

I was very much interested in Frederick H. Pough's article on the volcano Paricutin, which is by far the most comprehensive article I have seen on that very unusual and awe-inspiring spectacle.

Our party visited this volcano last February and were fortunate to be present during a period of violent eruption. I was especially interested in the photograph showing the discharges of static electricity over the crater, which I observed a

number of times during our stay at the Observation Hut. Several of our party refused to believe these flashes were from electricity, and I am therefore glad to find my original idea confirmed in Doctor Pough's article.

J. C. COLLIER,
Dubuque, Iowa.

SIRS:

I enjoy your magazine from cover to cover, but I particularly enjoyed "Two Fishing Cats that Made History," by E. W. Gudger.

BETTY BAUMAN,
New York, N. Y.

SIRS:

I have just received the intensely interesting letter from the Membership Secretary concerning the work of the American Museum of Natural History. . . .

Let me say that it brought me no small pleasure to learn that the Museum is still able to carry on its several divisions, affording such notable educational service to the thousands both here at home and abroad. It is pleasant to realize that, although I hold only an Associate Membership . . . I have had a share, however small, in helping to give pleasure to so many others. . . .

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Washington, D. C.

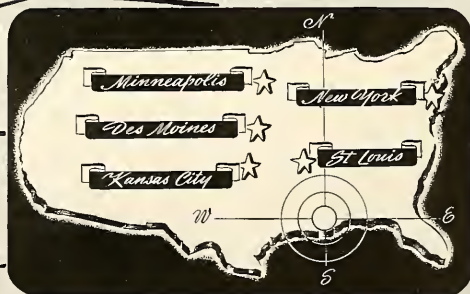
SIRS:

. . . We were greatly pleased with your article on Australia in the October issue. I have taken out the evolutionary tree of the marsupials and posted it on the bulletin board in my laboratory. . . .

HARRIET C. WATERMAN,
Department of Zoology and Physiology
Wellesley College, Wellesley, Mass.

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The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ALBERT E. PARR, Director

VOLUME LIII—No. 10

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DECEMBER, 1944

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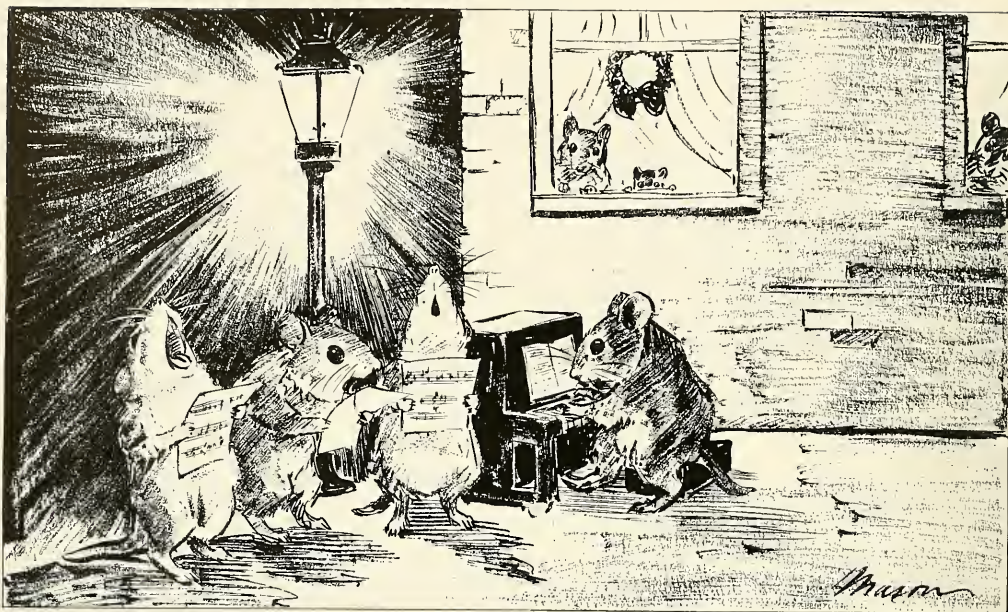
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SINGING MICE



By JOHN ERIC HILL
Drawing by
G. FREDERICK MASON

ON the short grass plains or on the sagebrush- and juniper-covered hills of the West, a tiny, high-pitched, musical song may be heard in the evening—the song of a grasshopper mouse.

This rodent is a close relative of our common white-footed and deer mice and is about the same size. It is stoutly built, with a large head and rather short tail. Its eyes are large and beady, but the ears are small. The soft, fluffy fur of its back and sides is gray, mixed with buff, while all the underside and most of the legs and tail are pure white.

The mouse received its name from its favorite prey, grasshoppers, for unlike its relatives, it is a hunter. It feeds on various sorts of insects and other small animals. Grasshopper mice readily attack and kill other mice. In spite of these habits and although they can bite fiercely, these mice become tame more readily than most rodents.

When a grasshopper mouse sings, it often stands up on its hind legs, poises its body like a concert singer, throws up its head, partly shuts its eyes, and gives out. The song is a fine, musical

squeaking, pitched so high that it is almost at the limit of human hearing, but it is smooth and prolonged. Perhaps the song is a claim to hunting territory, or a sequestration cry, saying, "Keep away from me, fellow hunters, there is food for only one here." It might be termed a howl rather than a song, for the fierce little mice are more like wolves than song birds. Certainly the mice do not cry from fear, and both males and females sing, if it be a love song.

Musical voices have been described in other species of our native mice.¹

¹See Dice, L. R., 1932, *Journal of Mammalogy*, vol. 13, pp. 187-196.

ON YOUR RADIO

Programs of the American Museum of Natural History for December, 1944

WEDNESDAYS

over WNYC & WNYC-FM

from 3:30 to 3:45 P.M.

Science for the Seven Million

Conducted jointly by Lucy Clausen and Julius Postal

Dec. 6—*Science in the News*

Dec. 13—*Woolly Warmth—The Why and What of Wool*

Dec. 20—*Winter Camouflage*

Dec. 27—*Turning a New Leaf*

FRIDAYS over WNYC & WNYC-FM

from 8:00 to 8:15 P.M.

Science for Freedom

Conducted by Julius Postal

Males of the golden harvest mouse, found in Texas, serenade in a fine high voice, when romantically inclined or possibly to express their high spirits. The closely related big-eared harvest mice of both sexes utter a clear, birdlike trilling song, audible at some distance.

Several years ago singing mice were discovered in two widely separated New York apartments. These were unusual individuals belonging to the species known as the house mouse. The people who heard these talented mice enjoyed listening to them sing. They had voices like canaries, according to the audience, and the novelty of hearing mice sing aroused considerable interest among the people living in these apartments. Such singing mice occur in widely separated places: Europe, China, Africa, Central America, and elsewhere. So far as experiments have been able to show, the ability to sing audibly is not inherited.

Why should just these few mice sing, when millions of others are not so gifted? There is a chance that the apparently silent mice do sing but in a voice pitched too high to be heard by human ears. Some creatures certainly hear sounds that we cannot. It may be that only mice that sing bass can perform for our human ears.

YOUR NEW BOOKS

PACIFIC WORLD • PATRICK GEDDES • MOLECULES
MEN OF SCIENCE • SNOWSHOE COUNTRY • DITMARS

THE PACIFIC WORLD

— — — Edited by Fairfield Osborn

W. W. Norton & Co., New York, price \$3.00, 1944. 218 pages, 18 colored charts and regional maps.

WHEN many experts co-operate to write a popular introduction to an important subject, the results are often informative but dull. Only the exceptional symposium is animated by the sparks of timeliness, life, and enthusiasm. The present attractive little volume is very definitely one of these marked exceptions. Written primarily for service men, for Army and Navy distribution, it has fortunately also been made available to their parents and others interested. It is, perhaps, the best brief popular introduction ever prepared on that vast, alluring, and challenging world of ocean currents and island masses which, on December 7, 1941, confronted the American public with such suddenness.

Under the sponsorship of the American Committee for International Wild Life Protection, a group of most able natural scientists, each personally familiar with the far-reaching waters and islands of the Pacific World, have here produced a very readable and informative book. Edited by Fairfield Osborn, it includes contributions from leading scientific authorities in the American Geographical Society, American Museum of Natural History, Arnold Arboretum, Blue Hill Meteorological Observatory, Carnegie Museum, Chicago Natural History Museum, Museum of Comparative Zoology, New York Zoological Society, and the Smithsonian Institution. Fascinating oceanic, anthropological, and faunal charts, by R. M. Chapin and others give the book charm and visual orientation. Tables and factual summaries at the end give it modest encyclopedic value. Some may feel that an even more detailed, but humanly evaluated bibliography would have been an important adjunct. But it should be pointed out that other handbooks, under the same sponsorship, are soon to appear on the Birds, Peoples, Mammals, etc., of the Pacific, which will contain more specific bibliographies.

The body of the book deals first with the more general and natural features of this highly variable ocean area. It discusses the geology, winds, currents, and constellations of the Pacific and then, very briefly, outlines human migrations, and the more characteristic animal, insect, and vastly important plant distributions of the western ocean world. The latter half of the book is concerned with thumbnail but vivid sketches of the various sub-

continental or island groups of the Pacific, their natural and human geography, history, and modern status. The brevity of these profiles may irritate some who know the actual complexities here so briefly summarized. Equally, however, both the critic and the neophyte may be stimulated to further reading and, perhaps, to much-needed field work in all the natural and social sciences that must now be brought to bear on the Pacific World. As William Beebe points out in his foreword, the final test of this book will be whether the reader goes further into this fascinating and increasingly important field for himself, as suggested for the newly returned veteran of the Pacific war: "Then when all the first excitement has died down, a new joy develops, permanent through all remaining years, when book after book is opened, dealing with the life of these now distant lands and seas. You, the reader, will sense the great difference between the time of your visit and the times when explorers of old sailed blindly and bravely through uncharted archipelagoes; you will be able to judge and condemn the exaggerations and falsities that will be found in too many modern volumes; but you will exclaim with delight, 'I've seen that very thing myself!' as you turn the magic pages of Captain Cook, Melville, Guppy, Alcock, Darwin and Wallace."

WILLIAM DUNCAN STRONG.

RAYMOND L. DITMARS

His Exciting Career with Reptiles,
Animals and Insects

— — — — — by L. N. Wood

Julian Messner, Inc., \$2.50
58 illustrations, 272 pages

FROM the turn of the century until his death in 1942 Raymond L. Ditmars was in charge of reptiles at the "Bronx Zoo." During these four decades he became a public figure, virtually as well known both locally and nationally as

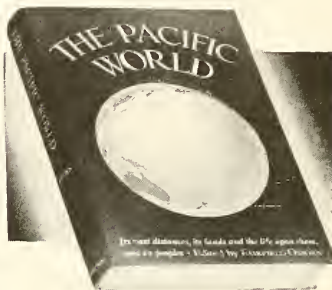
Continued on page 439

NATURE ENCYCLOPEDIA

Edited by G. Clyde Fisher; five volumes bound in De Luxe Green Keratol lettered in Gilt; pages are 5 3/4 x 6 inches. Lives and habits of Birds, Mammals, Fish, Reptiles, Flowers and Trees; described by renowned Naturalists; 700 illustrations, 200 in Natural color. The Literary Mart, 8 East 33rd St., New York 16, offers this set for \$6.00, remittance with order, returnable for full refund within five days.

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The Pacific World



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FAIRFIELD OSBORN

President, New York Zoological Society

Introduction by William Beebe

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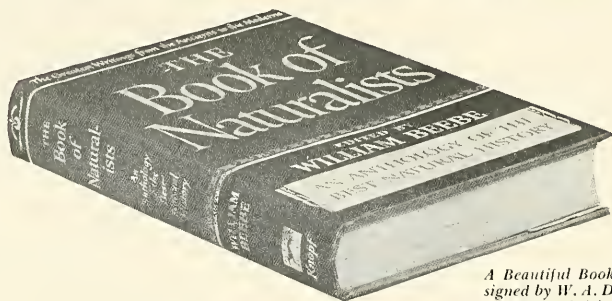
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THE BOOK OF NATURALISTS

edited by William Beebe

In all the literature of science no better writing exists than in the field of natural history. Dr. Beebe has here selected outstanding examples of such literature from Aristotle to our contemporaries. To them he has added two long introductory surveys and short biographical notes about each of the 53 contributors. The result is a book which traces the growth of man's knowledge of nature through the centuries—a treasury of fascinating reading, a gift of permanent value and distinction.

Ten stories of animal life in the High Sierra

ONE DAY ON BEETLE ROCK

by Sally Carrighar



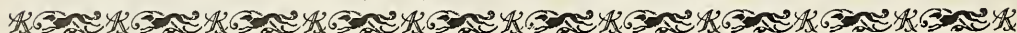
It is June 18, high tide of the year for the animals to whom Beetle Rock is home. In these singing pages we follow for twenty-four hours the hunts and foragings, the games and rests, the escapes and friendships of nine animals.

"Delightful and memorable . . . she has a vivid and refreshing way of writing and a touch that makes for enjoyable reading . . . the illustrations, too, are just right."

—PEARL CHASE, *President, California Conservation Council*

ILLUSTRATED BY HENRY B. KANE. \$2.75

These books are for sale at all bookshops. They are BORZOI BOOKS, published in New York by Alfred A. Knopf



Mayor La Guardia. Ditmars had a natural flair for publicity, perhaps born of his early experience as a reporter for the *New York Times*. He knew what struck the public fancy, and perhaps it was this same ability that made him a successful writer of popular books.

Ditmars' writings, more than those of any other author in his generation, created an intelligent interest in reptiles that displaced many of the erroneous notions so widely entertained. However, not all of his time and energy were devoted to popularizing reptiles. This biography traces his career from the time when he was a boy, struggling with his parents for the right to maintain snakes as pets, through his apprenticeship as an assistant in entomology at the American Museum (a college education was no prerequisite 50 years ago), and through his long career at the New York Zoological Park.

It provides the highlights of his trips abroad, to North Africa, and to Honduras, Trinidad, and Brazil in the American tropics (with perhaps too much emphasis on his continued quest for the bushmaster). His part in the founding of the Antivenin Institute, his associations with Noguchi, Calmette, Mitchell, Hornaday, and other celebrities of his day—all these are woven into a smoothly-running account, heavily loaded with imaginative dialogue that is anything but boring. Moreover, the account is reasonably accurate.

There is a quotation from the *Herald Tribune* to the effect that Josef Stalin, Mickey Mouse, and Raymond L. Ditmars were all included in "Great Britain's hagiography of the living for 1934." It represents a commentary on Ditmars' inclusion in the "compendium of the eminent" that is not so flippant as it seems on first glance. After all Messrs. J. Stalin and M. Mouse have become international figures of no mean reputation.

C. M. BOGERT.

THE BOOK OF NATURALISTS

----- edited by William Beebe

Alfred A. Knopf, \$3.50, 499 pages

ACCORDING to the subtitle this is "an anthology of the best natural history," and who is a better judge than William Beebe, one of our leading literary naturalists. Beebe has done here for natural history what Harlow Shapley and his associates did for the whole field of science in the recent excellent anthology, *A Treasury of Science*, and in an earlier volume, *A Source Book in Astronomy*. *The Book of Naturalists* is a worthy companion volume, and there is no duplication of Shapley's selections.

Some naturalists might have selected "The Canada Goose," by Audubon instead of "The Wild Turkey." Some would have chosen Burroughs's "In the Hemlocks," which contains his superb description of the song of the Hermit Thrush and of the flight-song of the Ovenbird, instead of "Old Friends in New Places." Others would probably have selected some of Chapman's gems on birds rather than the description of the behavior of the howler

monkeys and other animals that visited his Big Almendro tree on Barro Colorado. Nevertheless, Beebe's book is a collection of many of the finest pieces of nature-writing from Aristotle down to the present time. The first part of the book, which corresponds in a way to Shapley's *Source Book in Astronomy*, begins with the cave paintings by an unknown Magdalenian artist of the Stone Age, down through the writings of Aristotle and Pliny and ends with Thoreau's description of Walden Pond. In the second part more emphasis is given to "writing which has claim to consideration on the ground of beauty of form or emotional effect," without deviation from truth. This section of the book contains masterpieces of writing by Darwin, Wallace, Agassiz, Huxley, Hudson, Muir, Maeterlinck, Fabre, Wheeler, Seton, and a score of others.

Beebe's introductions to the two parts of the book, as well as his brief introduction to each author, add much to the interest.

CLYDE FISHER.

SNOWSHOE COUNTRY

----- by Florence Page and Francis Lee Jaques

Univ. of Minnesota Press, \$3.00
46 illustrations, 110 pages

"SNOWSHOE COUNTRY" is an apt title for this latest book by the Jaques, and they make a very appropriate and efficient partnership for producing the book. She writes with a fine appreciation of the beauty about her, and is an artist in words; he scans the environment for the most effective picture to be captured by his brush or pencil, an artist in lines and in lights and shadows. The book is charmingly written and beautifully illustrated.

The text records the events of a fall and part of a winter spent in a remote section of Minnesota. The treatment is chronological and appears as a diary with date headings. The writer-artist team went into the woods with the definite purpose of getting the utmost out of their experience with the country and the winter. They had no commitments on their time and they did as they pleased.

Not only does the author write understandingly of the beauties of nature, she misses little of the human interest in her contacts with the few people about her. The demands of a rigorous winter call for hardy self-reliance from those who remain after the first snows fall. A keen sense of humor serves to spice the pages of this book.

The presentation of subject matter as an informal diary should call for special reading. The author sets down, day by day, the most vivid impressions for those times. A great many of these are visual impressions in which color, form, and association call for superlative terminology. The reader will not experience these impressions spaced as they happened, unless he decides to confine his reading to a single date entry at a sitting. To read the book at one or two sittings is like making a meal of cocktails or desserts, the usual highlights of a meal. These pages should be tarried over, savored, and the mental

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images left to dwell on the inner retina.

This is a fine book to have lying about where it may be picked up frequently for the stimulation it gives both to eye and mind.

H. E. ANTHONY.

MEN OF SCIENCE IN AMERICA

----- by Bernard Jaffe

Simon and Schuster, \$3.75
52 illustrations, 600 pages

IN this book, the author has given us a series of nineteen readable biographies of great American scientists. Preceding these is a most interesting introduction of some twenty pages in which Mr. Jaffe tells us how he selected the outstanding scientists. While no two persons would have made the same selection, it must be admitted that careful consideration was given to these very debatable decisions. In a book of this kind, it is inevitable that some hero-worshippers will be disappointed in what they consider inadequate treatment of a particular scientist.

By his manner of treatment with its generous use of superlatives, it is evident that Mr. Jaffe is himself a hero-worshiper, and this reviewer has much sympathy with that approach. We have here a very human story of the lives and achievements of American scientists. The author gives us more than a mere series of separate biographies, as indicated by the subtitle of the book, *The Role of Science in the Growth of our Country*. Con-

Continued on page 483



These people buy a battleship —every week!

Meet John S—— and Mary D——

John works at an electronics plant on Long Island, and makes \$85 a week. Almost 16% of it goes into War Bonds.

Mary has been driving rivets into the hide of one bomber after another out at an airplane plant on the West Coast. She makes \$55 a week, and puts 14% of it into War Bonds.

John and Mary are typical of more than 27 million Americans on the Payroll Savings Plan who, every single month, put a half a BILLION dollars into War Bonds. That's enough to buy

one of those hundred-million-dollar battleships every week, with enough money for an aircraft carrier and three or four cruisers left over.

In addition, John and Mary and the other people on the Payroll Plan have been among the biggest buyers of extra Bonds in every War Loan Drive.

When you come to figure out the total job that John and Mary have done, it's a little staggering.

They've made the Payroll Savings Plan the backbone of the whole War Bond-selling program.

They've helped keep prices down and lick inflation.

They've financed a good share of our war effort all by themselves, and they've tucked away billions of dollars in savings that are going to come in mighty handy for both them and their country later on.

When this war is finally won, and we start giving credit where credit is due, don't forget John and Mary. After the fighting men, they deserve a place right at the top of the list. They've earned it.



You've backed the attack—now speed the Victory!



NATURAL HISTORY Magazine



A CHRISTMAS GIFT

By THANE L. BIERWERT

Acting Chief, Division of Photography,
The American Museum of Natural History

To Last Through the Year

IF YOU are looking for something new and different this Christmas for your housekeeping friends, consider the possibility of making up some photographic place-mats for the dining-room table. A touch of the out-of-doors added to the table is always welcome, and a set of six place-mats fashioned from your best pictures is certain to be appreciated in any home. Of course, there is always the possibility that your friends may like them so well that they will frame and hang them on the wall, instead of merely covering them with dishes!

So far as I know, no one has written about this use for pictures. Custom states that photographs be considered aesthetically, rather than for utilitarian purposes. However, it's good practice to break customs—and this is one instance.

Any negative that will enlarge to 11 x 14 or 14 x 17 can be used. And if you have one particularly handsome picture, there is no reason why all the mats should not be the same. The subjects having the most universal appeal are those with designs or patterns—close-ups of tree leaves, ripples on the sand, groups of flowers, or high lights and shadows on snow. If you happen to have a summer place, use scenes from there. If you have made a pleasant trip out West or elsewhere, select the most striking views, pictures that make you want to return. There is no end to the possibilities. Remember that the prints should have photographic quality and a lasting appeal, as you will want them to be seen many times during the year.

The size of the average place-mat is 10 inches by 15½ inches. It is readily seen, therefore, that a photographic paper 11 x 14 inches will be satisfactory if we sacrifice a bit on one dimension. This size will readily accommodate both silverware and glasses, as breakfast, luncheon, tea, or dinner plates are seldom larger than 8½ inches in diameter.

Enlarge your pictures in the usual manner, using a mat or semimat paper of single or double weight. By making them without borders, you will save valuable inches. This can be done by covering the paper with a piece of glass. Be sure that it is clean and scratch-free, or a long and tedious spotting job will be necessary to remove the spots and lines from your prints. A "Stay-flat" board, if you have one, will produce even more satisfactory results than the glass.

If you wish, you can tone your pictures sepia or blue or any other desirable color. In doing this, consideration may be given to the color of the dishes used, although most tableware will blend with any of the tones better than with black and white photographs.

Mount your prints on cardboard, on novelty shop cork mats, or on print



Photograph by Thane L. Bierwert

▲ NATURE PHOTOGRAPHS, mounted as place-mats, add a pleasant decorative effect to the table

mounts. Dry mounting is to be preferred over that of rubber cement, as it is more permanent, non-staining, and far more reliable, considering the quality of the present-day rubber cement. Trim the prints flush, with no margins or borders. These picture-mats will have no titles. Remember to round the corners, however, to keep them from becoming broken and dog-eared.

Now to protect the surface of the print—something about which you may have been worrying. If you have ever waxed or lacquered or varnished a print, the problem is a simple one, for the process is the same. A wax paste, of the type used on furniture or automobiles, can be rubbed over a mat print to give it a beautiful luster and a coating that is impervious to water, coffee, grease, or other stains. A similar protection may be secured by using a transparent lacquer or varnish such as "Syn-Var," clear "Duco," or a prepared print lacquer. If complete protection is desired for the top, sides, and bottom of the mat, paint all of the exposed surfaces, thereby sealing the paper entirely from moisture. This last precaution is especially valuable when there are children in the family.

Your place-mats are now ready for use. One word of caution, however: be sure to stack the mats in a flat position, as they will have a tendency to curve slightly. It is wise to think of this in advance and to mount the prints on board that is strong enough to hold its shape.

If your friends have enjoyed your Christmas cards and the snapshots that you make of your family during the holiday season, or if they have actually hung the pictorial print you gave them as a present, they will appreciate even more having and using a set of your pictorial place-mats.

THE COVER THIS MONTH

THE ANIMALS depicted in full color on the cover are Dall or White Sheep (*Ovis dalli* Nelson) as portrayed in the American Museum's Hall of North American Mammals. They are smaller than the Big-horn Sheep and have long, gracefully spiraling horns. Although they are true sheep, their coat is hairy and not woolly. Living as they do among the snow-capped mountains of Alaska, the coats of these Dall sheep remain white the year around. Farther south, however, the coat darkens until in British Columbia we find a subspecies of very dark sheep.

These mountain sheep are extremely sure-footed and are not found far from steep and broken country. Their keen senses make them wary game, and they depend more upon their eyes than upon their ears or nose to detect an enemy. When frightened, they usually climb to the most inaccessible cliffs. White sheep live and spend their lives in a limited area, often within a five-mile radius. In the winter, the snows force them down to lower altitudes.

Except during the rut, the Dall sheep divide into three groups: the big rams; the ewes and lambs; and the 3-year-old rams, or bachelors. The young, born in late May or early June, are weaned in August, but they stay close to their mothers for some time. In their third year the young rams join the bachelor group, and in the fourth or fifth year they fight their way into the band of older rams.

The habitat group shown here was collected and presented by Mr. and Mrs. Richard K. Mellon. Mt. McKinley, Alaska, flanked by two long winding glaciers, forms the background. The exhibit was photographed in color by Thane L. Bierwert and Dwight Bentel.

Eagles WILD and

*All photographs from Palisades
Interstate Park Commission
by Harold K. Whitford*

Every winter, swooping over the frozen Hudson, they present a display of scenic wonder that is rivalled only by that of the country they symbolize—and they are useful as well



GOLDEN EAGLE THOR, in "heraldic" pose

TAME

By WILLIAM H. CARR

*Director of the Bear Mountain Trailside Museums
and Associate Curator, The American Museum of
Natural History*

THE owner of one of the largest newspapers in New York City has a consuming interest in eagles. Each winter, when ice appears upon the Hudson River and Bald Eagles arrive from various points to spend the season in the region, this executive makes certain that the story appears in his paper. Each day when he rides the train along the river bank to his office he watches the birds from the window. Their presence provides him with much enjoyment and he believes in sharing his pleasure with his readers. "When the bird that represents our national emblem comes sailing along over the ice and steals fish from the sea gulls, I believe the people should know about it. It is an event. A newspaper can't live on war and murders alone." So says this business man, and we agree with him.

The American bald eagle is a striking bird, and when it enters New York's metropolitan environs and continues to do so through the years, it is an "event" to be certain. Thousands of commuters along the shores of the Hudson and many townspeople in the



▲ THOR quickly learned to cling to a heavy leather glove with his sharp, powerful talons

vicinity are familiar with its presence. They see the broad-winged bird as it flies along over the river, perches on ice cakes, and soars gracefully over highways and railroad tracks skirting the river. During the winter 1943-44 there were eight eagles in the area extending from the river's mouth to a point roughly 50 miles inland. On one occasion we saw six of them together. Winter visitors usually arrive in December and leave in mid-March. Bald eagles have also been seen in the neighborhood of Bear Mountain Park, 45 miles north of New York City,

during all of the warm months of the year, including July and August, but we believe that the summer birds may very well be nonbreeding individuals.

Sixty years ago the birds were more numerous. Dr. Edgar A. Mearns, a leading American naturalist of his time, stated that he had counted more than 25 in view at once. Writing in 1880, Doctor Mearns reported poetically that, "The white-headed or bald eagle constitutes a marked and romantic feature of the superb scenery of this part of the Hudson [The Hudson Highlands], lending another charm to a scene already grand and impressive, but rendered sublime and awe-inspiring by the presence of this noble bird, seen perched upon some blasted tree above the massive cliffs, or soaring in higher atmospheric regions, far above the coming tempest. . . . In winter, when the river is frozen, the eagles are seen soaring above the mountains, searching for the scanty prey upon which they are obliged to subsist when fish, their favorite food, is unattainable; but later, when the ice is in motion in the Hudson, carried swiftly by the current, numbers of them may be seen sitting in pairs in trees down by the river's edge, waiting for their finny prey, or else floating upon the ice in the stream, in company with crows and gulls."

The winter activity of the birds centers about the never-ceasing search

▼ THE LARGE BIRD is a great favorite with the public at the Bear Mountain Trailside Museums, where he has been "at home" for five years



for food, today as in the past. In a sense our eagles are bandits. Our feathered national emblem by no means lives an exemplary life so far as his pursuit of a livelihood is concerned. The larger birds do not hesitate to steal fish from their noisy river companions, the sea gulls, whenever the opportunity presents itself. We have observed this thievery many times, often through high-powered telescopes, and we never cease to marvel at the ease and skill with which the eagles succeed in obtaining food in this manner.

One cold February morning we visited the neighborhood of Peekskill Bay to count and identify the ducks that were floating about in stretches of open water between the moving ice floes. We set up our telescope on a high cliff overlooking the area and were about to commence the tabulation when we saw a fine white-headed eagle perched in a chestnut oak not more than 100 yards distant. The winter sunshine reflecting from his head caused him to stand out sharply against the rather somber background of the mountainside. His sharp eyes were searching the river as he sat there.

From far below, we heard the faint cries of a group of herring gulls. They were wheeling about one of their companions that had succeeded in capturing a fish and had pulled it to the center of a small floating ice cake. A tug of war was in progress as one avaricious gull attempted to snatch the prize from the other. The fish changed beaks several times as the competition went forward.

Presently, there was a stir up the river as the eagle left his perch and glided toward the scene. We were able to catch the bird in the field of our telescope and follow him throughout the succeeding action. Without so much as a flap, he gathered momentum and approached the fighting gulls. When he was not more than 20 feet from the ice floe, all of the gulls suddenly took to the air, screaming and milling about. With masterly precision, the eagle sailed lower and lower and then, without a pause, swooped over the ice cake, reached down with his right foot, embedded his powerful talons in the now deserted fish, and continued on down the river to alight on another ice cake some quarter of a mile away, where he proceeded to feed in leisurely fashion.

Soon another eagle, attracted by the

commotion, circled above the diner. The thief raised his head and protested with high-pitched calls, whereupon the unwelcome investigator flew off. There were hundreds of black ducks and American mergansers flying and swimming within 50 feet of the ice floe. When the eagle finished his meal and soared above the ducks, they seemed to pay no attention to him whatever. We have yet to observe an eagle that made the slightest effort to molest ducks upon the river. The gulls had followed the eagle for a short distance, directly after he had grasped the fish, and though they settled on ice cakes not far off, they made no attempt to retrieve the fish.

On another occasion, in the same general vicinity, one of our associates saw an eagle pounce upon another bird—the only instance of this kind that has come to our attention. The eagle, hunting close to the surface of the river, suddenly dove upon a swimming gull, struck it upon the back, and held it under water for a matter of a minute or so. The eagle had its wings spread wide apart during the procedure. As far as could be determined, it never struck the gull with its beak, but sprang upward, after a moment, and landed upon the ice a few feet from the open spot of water in which the gull had been swimming. The gull immediately came to the surface, looked about with a bewildered air, and quickly took to its wings. It would seem that if the eagle had intended to kill the bird, it could have done so very easily. Whatever the eagle's intention, it was evident that the gull had not been badly injured. We know that there are other records of this sort, but years of observation in the Hudson River area have failed to produce another in our experience.

The eagles seem to divide their time between perching ashore or on the ice, and soaring above the river. Toward the end of the winter especially, they become rather "tame" and will remain in a tree until a person walks very close to them. It is great wonder that more are not shot, despite the fact that a stiff Federal fine awaits the hunter who slays one of these birds.

Sometimes, when the Hudson is completely covered with ice, the birds will hunt food inland, coursing along near the summits of the hills not far above the tree tops, duplicating, to a certain extent, the behavior of the

turkey vulture in the summer time. They also scan the roads and come down to feed upon rabbits that have been killed by automobiles. On one occasion we narrowly avoided striking one of these birds that was slow in rising from the road ahead of our car. Its wing tips almost brushed the car roof.

Although the foxes, both gray and red, provide a certain amount of serious competition, we nevertheless believe that the eagles feed upon deer that have been slain by dogs or have succumbed to the severity of the winter. Regardless of this, the eagles must often experience difficulty in finding enough to sustain them during protracted periods of zero weather.

The bald eagle, with his snowy head and tail and his easily observed activities, is by all odds the most conspicuous bird of his tribe upon the river and in the neighboring hills, but there is, nevertheless, another species of eagle that occasionally visits us in the winter time. This is the Golden Eagle.

The first one we ever saw at close range came to us in a very strange fashion one New Year's Eve several years ago. A man drove into the parking space at our Trilside Museum, came to our office, and announced that he had an eagle for sale. We at once learned that the bird was dead and were suspicious that the man had killed it. However, we were able to keep our ideas to ourselves and asked him to bring the bird to us. It proved to be a magnificent golden eagle in excellent plumage. One of its feet was badly swollen and lacerated, and it became evident that it had been caught in a trap.

With questioning, we learned that the bird had been found in a trap set for fox. The unlucky eagle had been attracted by the meat placed upon the trap treadle. Hunger, plus keen eyes, had led to its undoing. The man decided that he could sell it to us, but he was greatly mistaken. We are by nature suspicious and we suspected at once that the would-be eagle merchant had set the trap illegally within our sanctuary limits, and this later proved to be the case. We brought the man, together with his eagle, to a nearby judge, where he was sternly warned not to set traps within Bear Mountain Park and also fully informed concerning the seriousness of trying to sell an eagle. The judge did not like to be disturbed on New

► THERE is an air of dignity and alertness which marks the eagle's every move

▼ BOY SCOUTS call this procedure "walking the eagle." Considerable rivalry often ensues concerning "who has the next turn"



► INTEREST, not alarm, marks this boy's expression. Children soon learn that Thor is a mild-mannered bird, despite his size



Year's Eve but he arose to the occasion nevertheless.

In 1941-42, a pair of golden eagles spent the winter in our Park and were seen almost daily in various places throughout the area. We never saw them near the river. They seemed to prefer the interior, where there were open fields and highways.

Our Park Rangers became familiar with them and made frequent reports concerning their whereabouts. The birds fed upon rabbits, and one of the men declared that he saw the male eagle in hot pursuit of a gray fox that attempted to cross an open field in late afternoon. Certainly the powerful talons of one of these birds, once properly implanted, could do great and instant damage. We have no doubt that a hungry eagle could make things very difficult for a fox in the deep snow.

Our most intimate experiences were with a beautiful golden eagle shipped to us from New Mexico, without advance notice. The eagle arrived in a wooden crate in a sadly disheveled condition. From the first, he was gentle and highly intelligent. After the experiences he had had in transport, we would certainly have seen to it that he was released in some suitable place. However, he had a broken shoulder and, in addition, his feathers were in no condition to permit this.

We do not like to keep birds of prey in cages, for only too often they strike the wire with their wings and soon look more like feather dusters than healthy birds. We did not keep Thor (for that is what we named him) in a cage. He lives today in a small house during the night. We carry him outdoors on the wrist each morning and place him upon his long, horizontal bar. He is tethered here by a leather strap which secures each foot separately. He has long since learned to accept this form of restriction and seldom strains at his leash. He sits all day long, making very few movements.

The shoulder is now completely healed, but we know that he would never be able to survive in the wild. Thus, it becomes our responsibility to care for him during his lifetime. He likes to sit in the open with nothing between himself and the sky but tree branches. He is in perfect condition, with every feather in its place—a handsome bird and a great favorite with visitors. We feed him small

pieces of horsemeat, and people delight in seeing the speed with which the meat disappears. Young people can put on a heavy leather gauntlet and carry him about. We can stroke his head and scratch the back of his neck.

Eagles in song and story are supposed to be fierce and unapproachable, but not Thor. In a sense he is a real pet. He weighs about 16 pounds and has a wing spread of nearly 6 feet. As the boys say, "He's no canary!" Despite his size, his voice is a high-pitched squeak and chatter. He has never "screamed like an eagle" during the five years he has been with us. A duck hawk perched near-by makes far more sound than he.

Not long ago we discovered that the big bird was gone and, as we stood near his empty perch wondering whether we would ever get him back again, we heard a great disturbance far off in the woods—a group of crows had found Thor for us. We discovered that he was surrounded by a shrieking mob of black birds that called him every name there was to call in crow language. There was Thor in the center of the conclave, unhappily clasping a large branch high up in a Red Oak tree. He could not fly from his tree top, due to the fact that the leather jesses, or leashes, attached to each of his strong feet were hopelessly snagged in the branches. It was necessary to climb the tree, untangle the bird, and carry him down. As usual, his disposition was excellent, and he made no attempt to claw or bite us as we descended.

Soon he was back on his perch in the shade of the Black Locust tree. His beak was open, for it was a warm day and he had been through a trying experience. In fact, it had been his first real flight in years. We sprayed him with a fine stream of water and this caused him to ruffle his feathers and settle down, a much cooler if not chastened bird.

Occasionally we would take Thor in the car on journeys to the animal shows which we staged for the education and, we hoped, the edification of the large crowds in neighboring communities. While journeying in the automobile he would lie upon his back on our laps and ride for miles without once trying to regain an upright position. To be sure, his talons would sometimes grasp the gauntlet very firmly and would sometimes shut off the circulation in the wrist, for eagles

have relatively tremendous strength. When we arrived at the roped arena where the show was to be presented, we would simply carry Thor to a perch and place him upright upon it. Thus transported and perched, he seemed perfectly content, and when his turn came to be paraded before the crowd, he would sit upon his keeper's wrist with full confidence, gazing at the crowd with unconcern as he passed by.

The aim and ideal of our performance was one thing—conservation. We would stress, over and over again, through loud speakers, that the various birds, animals, and reptiles we displayed were all good citizens of our land and deserved the protection of all and sundry. We stated that many birds of prey performed a real service by virtue of the destructive rats and mice they consumed. We pointed out that the eagle deserved the well wishes of everyone because he destroyed a great many creatures injurious to crops.

One afternoon, when we had concluded our little lecture, a gentleman in the audience arose and said that as far as he was concerned, every eagle could be killed. He related that when he was a boy upon a western ranch, the eagles would fly off with full-grown sheep. We indicated that experiments had shown that eagles could hardly leave the ground with objects weighing more than eight pounds. "No sir!" said the erstwhile sheep man, "one of them birds would come sailing down from the mountains, snatch a full grown sheep and, before you could say 'boo,' off he'd go, sheep and all. Why, I seen 'em with my own eyes, time and again!" Another voice from the crowd came to our assistance. Said the voice, "Them sure must have been some eagles!" All of which proves that when a fish story leaves its rightful element and takes to the air, it is still a fish story.

Thor's reactions to people, to dogs, and to life in general is consistently interesting. Unless visitors approach too closely, he pays scant attention to them. Dogs quickly learn to keep their distance. The bird glares at them and lunges forward with wings spread and feathers ruffled, if the animals come too near. The spreading of his wings is sufficient to cause any dog to retreat in confusion. When the hawk migration season is in full swing, Thor watches the high-flying birds as they appear from the Northeast and vanish toward the Southwest. Thor often

discovers birds that are too high for our eyes to catch, and we run for our binoculars.

In a sense, birds in zoos are ambassadors of their species. They undergo certain sacrifices which enable educators to stress their value in the scheme of economics, conservation, ecology, and esthetics. We have always be-

lieved that great opportunities are missed when various captive birds and animals are considered as mere exhibits and not as living "first-hand" educational aids.

Thor does his part by permitting us to inform thousands of visitors concerning the habits of eagles in general. His handsome profile is captured by

hundreds of photographers annually. Many persons return to see him, year after year. Perhaps some gunner will swing his sights away from a wild eagle, thanks to knowledge and appreciation gained through acquaintance with the large golden bird that sits so patiently on his perch under the locust tree.

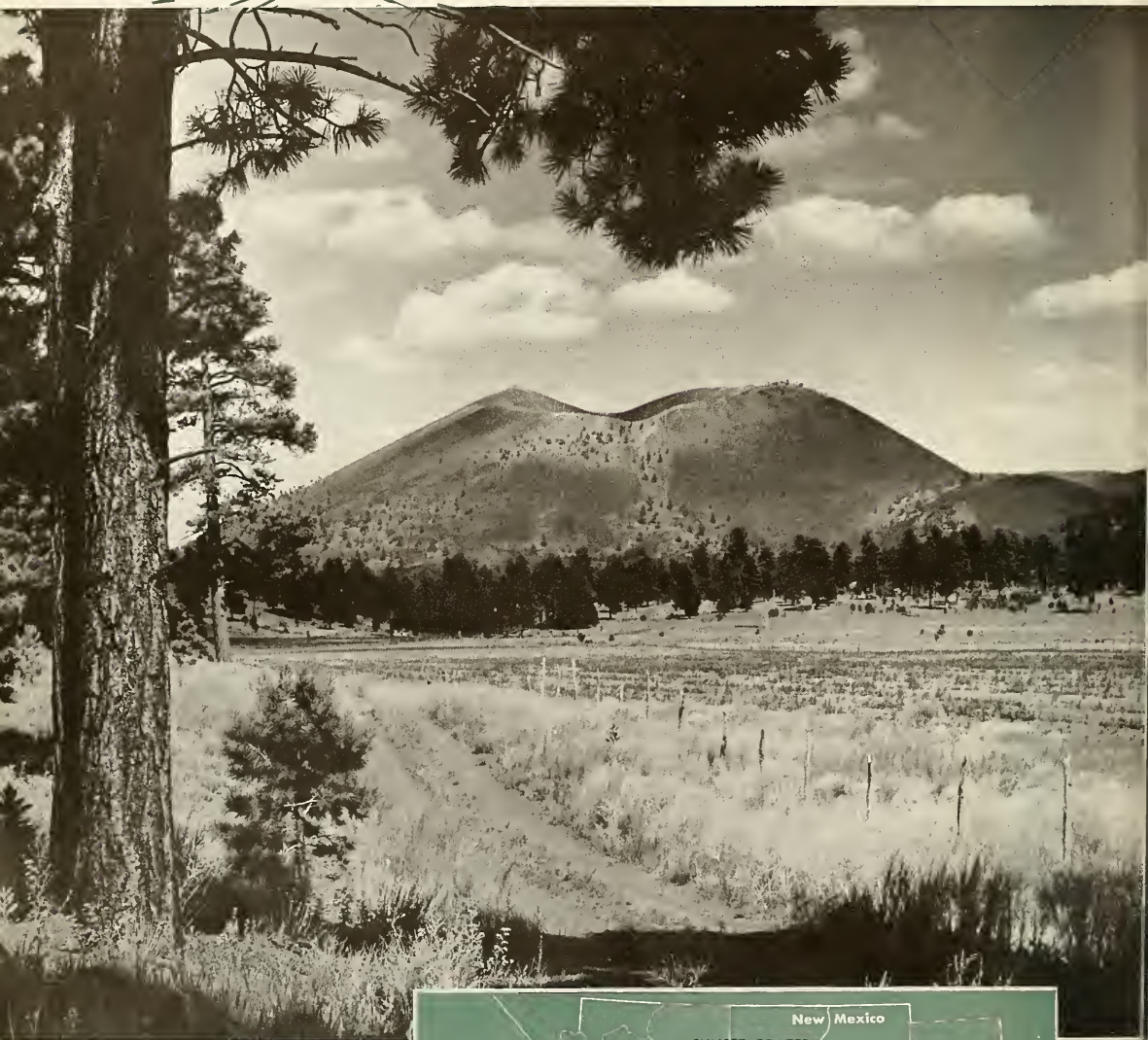


▲ THE CAMERA'S SHUTTER clicked at 250th of a second to catch the eagle's protective eye covering in position

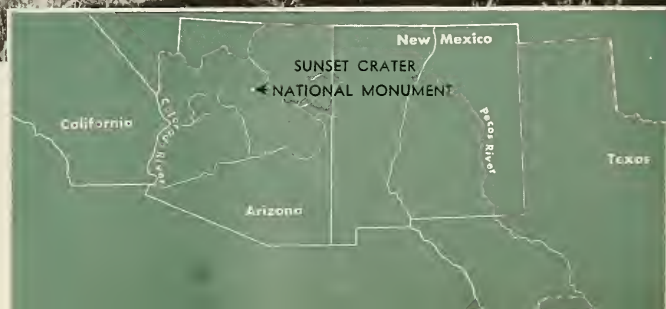


SUNSET

Ten centuries ago a volcanic outburst showered ash over an area of 1000 square miles and made a fertile haven for a thriving Indian population. A pictorial presentation of one of our National Monuments



▲ SUNSET CRATER'S CONE, unlike most volcanoes, is brightly colored with red, orange, and yellow. These hues were imparted by oxide of iron and sulfur in the gases escaping from the crater during the last stages of its eruption. Their resemblance to the colors of the setting sun is responsible for the mountain's name



CRATER

By TAD NICHOLS

► LOOKING westward from Sunset Crater, one sees the San Francisco Mountains, highest peaks in Arizona. Cinder-covered Bonita Lava Flow, visible in the foreground, emerged from the base of Sunset Crater



◀ THE INDIANS who inhabited this ancient pithouse saw the eruption and were driven from the region by the rain of ash. Archaeological evidence from sites such as this shows that the eruption occurred between 700 and 900 A.D. But what was a disaster for these people proved a boon to their successors

▼ THE LAYER of black ash formed a fertile soil, and around 1050 A.D. a later group of Indians were encouraged to re-populate the region. The Pueblo of Wupatki, shown in this photograph, is one of the largest prehistoric ruins within the cinder area

▼ SCATTER-CONES. Large and small incandescent fragments, carried into the air by the hot, roaring gases, fell back to form these steep-sided chimneys of interesting shapes and sizes





◀ **THROUGH CRACKS** in the hardened surfaces of flows, sheets of semi-plastic lava were forced upward by the intrusion of molten lava from below. In places these thin slabs of basalt reached a height of ten feet before arching over and breaking under their own weight. These unique formations, appropriately called "squeeze-ups," are one of the interesting features that reward the visitor who explores around the base of Sunset Crater

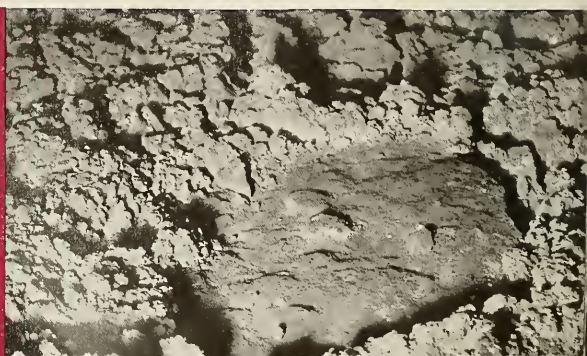
➤ **WHEN** a thick and strong crust formed over a lava flow, the still fluid material underneath sometimes drained away, leaving a large elongated cavity. Such a tunnel exists in the lava to the west of the San Francisco Peaks. When the tunnel was formed, it contained a river of red-hot molten rock, remnants of which eventually hardened to form the floor of the cave



➤ **OFF TOWARDS THE EAST**, some of the cinder cones of the San Francisco volcanic area lend a gently rolling contour to the edge of the Painted Desert. Many of them, stretching in line along the level plateau, apparently broke out where the lava found its way to the surface through fractures in the earth's crust

▼ **ENTRANCE TO THE LAVA RIVER CAVE** is gained through a jagged hole at a point where a portion of the roof collapsed. For three-quarters of a mile one may follow the winding cave, walking up the lava stream to a place where the floor rises to meet the roof, blocking any further passage

▼ **BLOCKS OF HARDENED LAVA** like this one were once part of the roof but fell and splashed into the molten river and were carried along by the stream

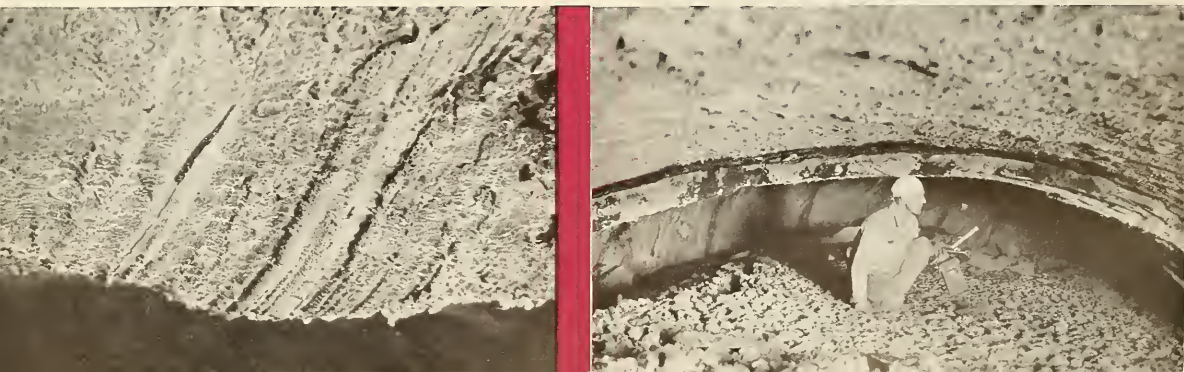




✎ WHEN THE LAVA ceased to flow and the cave began to cool, shrinking of the rock caused long cracks to form, concentric with the roof and sides.

Above the ground as below, the eruption of Sunset Crater seems sometimes to have been primarily destructive. The jagged, angular blocks that are heaped up in some areas are, to be sure, even difficult to walk over; but the vast areas of fertile soil that were produced by the ash were like a gift from heaven to the Indians who moved in to make the region their home

▼ AT TIMES, the river of fluid rock rose until it scraped the roof and then subsided, leaving grooves



LADY LUNA

Miracle Worker

By JEWELL CASEY

PHOTOGRAPHS BY THE AUTHOR

ONE of the most beautiful insects is the exquisite luna moth. And since moths fly mostly at dusk or after dark, they are less known to most people than are the butterflies.

To obtain the best photographs of these night-loving insects, it is almost necessary to have them indoors where the different stages of development may be watched and where proper lights may be had.

It has been my happy experience to watch every step in the life of the lovely luna moth and to record the changes with my camera, as shown in the accompanying pictures.



1 ▲ CLINGING TO THE BARK OF A TREE I found a lovely luna moth. From the plump body and inconspicuous antennae I knew she was a female. Her torn and drabbed condition suggested that her cycle of love had been completed and that she had now to lay her eggs and die



4 ▲ WHAT'S WRONG? The caterpillar has stopped eating and changed to a deep, dark, poisonous green. It has shrunk to almost half-size and moves restlessly from one object to another. Settling finally on a pecan branch, it begins to spread silk over leaves and twigs to form the basis for the cocoon



5 ▲ SOON Caterpillar had fashioned a cradle of leaves, held together with silken threads spun for the purpose. On and on the poor larva toiled. A leaf, clipped from the branch by Caterpillar's short mandibles, was drawn by silk thread to cover the cradle



- 2 ▲ AN HOUR OR SO after being placed in a dark box, she laid several very pretty greenish-gray eggs. Seven days later tiny dark-green caterpillars emerged from the shells. So that they would reach maturity in perfect condition, they were placed in a glass jar—



- 3 ▲ AND KEPT WELL SUPPLIED with two foods to which they are partial—pecan and walnut leaves. After a month of feasting (except for short periods when shedding the skin) the caterpillar had reached full growth—in a bright green suit with ruby dots for trim



- 6 ▲ AT TIMES Caterpillar seemed weary, yet the urge to finish the task was great, and hundreds and hundreds of yards of pure silk thread were spun for lining the cradle and filling the cracks. After twenty-four hours the snug home was ready for the winter-long sleep



- 7 ▲ THE COCOON was removed from the branch and put away in a box for safe keeping. One warm day in late March a scratching sound was heard. Soon a hole appeared in one end of the cocoon and—just as camera was put in position—the moth's head appeared!



8 ▲ COULD THIS SORRY SPECTACLE, half wormlike and half mothlike, bursting from the cocoon, be a child of our exquisite Lady Luna? Note the fuzzy body with its awkward, inadequate wings and its green bands reminiscent of the caterpillar stage still showing against the pure white of the moth

9 ► WE WATCHED the changeling begin testing its legs and embryo wings by crawling along an iris stem. It flexed its wings vigorously as the tiny veins in them were filled with air



10 ▼ HERE THE WINGS have expanded but are still soft and incapable of flight. Reposing in symmetrical silhouette, the lady patiently awaits the hardening of the wing substance that must take place before use



11 ▲ RESPLENDENT in queenly ermined body and displaying a wing-spread of almost five inches, Lady Luna has shed the last resemblance to a caterpillar. As lightly as thistle down, she flits across the room. Her graceful wings are bejewelled with translucent eye spots that are bordered with rings of pale yellow, blue, and black and are the delicate green of the iris stem she has just left. Her feet match the orchid tint of the blossoms, and there is a delicate band of orchid across her wings. The feathery straw-colored antennae, the lavender border of the fore-wing, and the long trailers add to the loveliness of Lady Luna. The "Miracle-Worker" has completed her marvelous transformation

WELL WELL WELL

The story of three extraordinary holes that were dug in the ground

By RUFUS MATHER BAGG

*Geologist Emeritus,
Lawrence College, Appleton, Wisconsin*

MOST people are surprised to learn that there is perhaps a third as much water underground as there is in all the oceans of the world. But more surprising still are some of the strange tricks underground water plays on man when he taps it for use.

One of the most astonishing wells in the world is one near Rapid River, Wisconsin, which gives both fresh and salt water. From one pipe flows a small stream of very salt water like a typical mineral spring. From another pipe issuing from the same hole flows a fine stream of excellent fresh water.

How such a thing happens is explained in the accompanying diagram. An 8-inch hole was drilled, and when it reached a depth of 85 feet, a salt water zone was struck. The boring was continued to a depth of 100 feet, where a 6-inch casing was inset; then the drilling was carried down to 262 feet. At this point, fresh water gushed up in volume. The drillers cut off the salt water from the fresh by cementing in a wooden plug at the 100-foot level. By inserting a 1-inch pipe in the salt water zone and a 2-inch pipe to near the bottom of the well, both salt and fresh water continued to flow steadily from this one well.

The mineral content of the salt water is interesting and was sufficiently high for the owner to attempt its sale for medicinal purposes. But the water was found too difficult to drink owing to the large amount of sodium chloride (common salt). It was like drinking sea water, which cannot be used safely by man even when dying of thirst.

This double well, known as the George Fuhrman Well, is a nice illustration of how different layers or zones of water are sometimes separated from each other by impervious rock. The first water level represents the margin of a sea that existed on the surface of the ground in Silurian times, about 350 million years ago. Considerable salt had been deposited

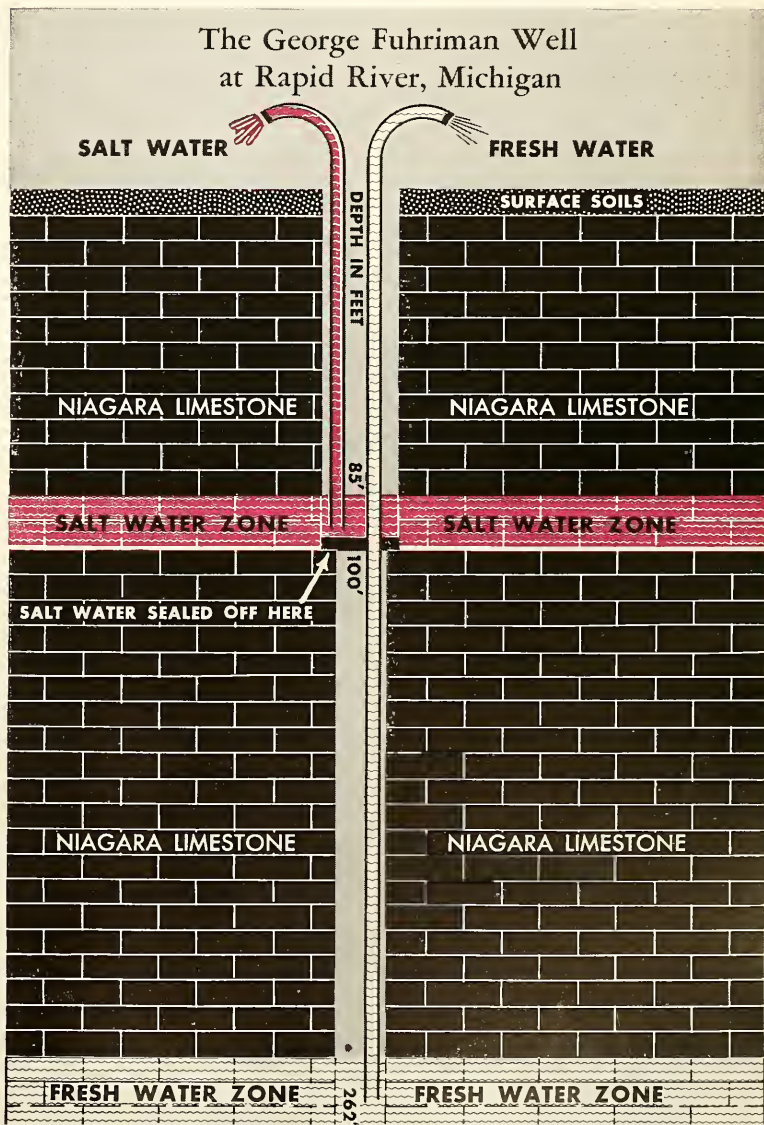
along the edge of this sea through evaporation, and the area was later covered over by other rocks. Today, water percolating through the deposits dissolves the salt; and the drilling of the well permitted it to flow to the surface. The fresh water from

the same well comes from deeper regions, and the water at this level has percolated through rocks in which no salt was deposited.

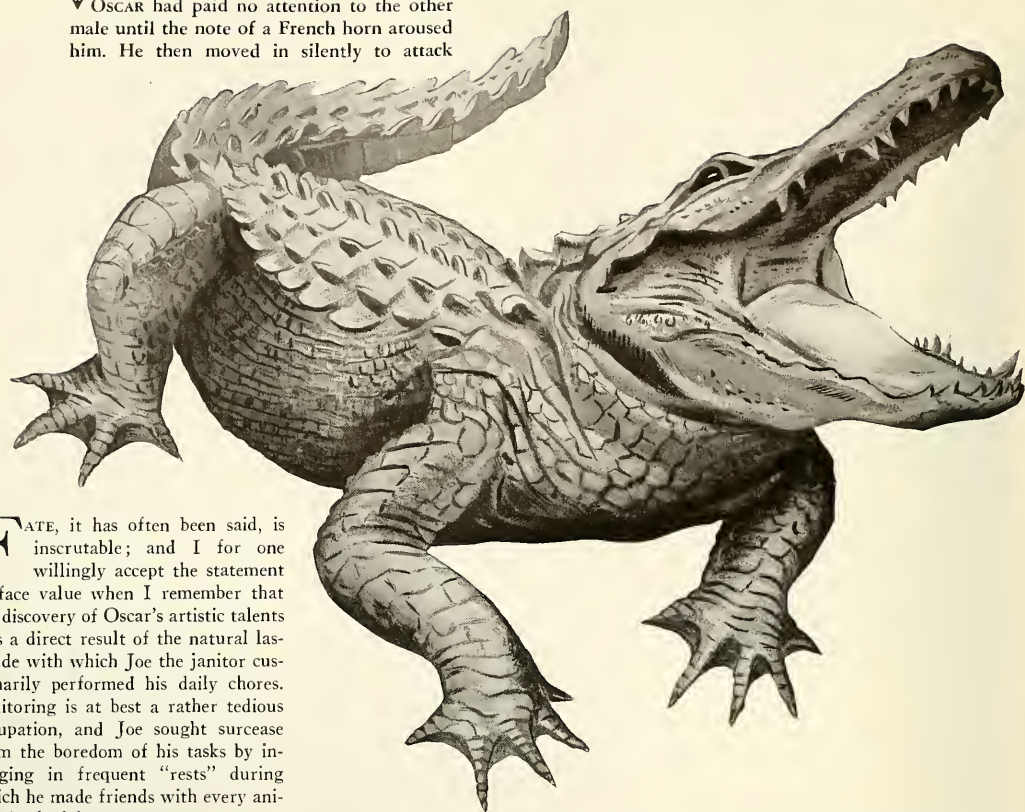
The largest well in the United States is probably the Oasis Cotton Company's well, which paradoxically is located in one of the drier sections of the country, near Roswell, New Mexico. This well is a little over 12 inches in diameter and about 900 feet deep, and it will throw a six-inch stream of water 50 feet into the air. The rated volume is over 13 million gallons every 24 hours. It is used for irrigation.

Continued on page 483

THE WELL that gave both salt and fresh water, and the explanation of how it happened



▼ OSCAR had paid no attention to the other male until the note of a French horn aroused him. He then moved in silently to attack



FATE, it has often been said, is inscrutable; and I for one willingly accept the statement at face value when I remember that the discovery of Oscar's artistic talents was a direct result of the natural lassitude with which Joe the janitor customarily performed his daily chores. Janitoring is at best a rather tedious occupation, and Joe sought surcease from the boredom of his tasks by indulging in frequent "rests" during which he made friends with every animal in the laboratory.

His methods of establishing rapport with his animal friends were varied and devious, but nearly always effective. Most creatures responded readily and wholeheartedly to Joe's overtures; but not Oscar the alligator. Oscar seemed to regard with cold and unrelenting suspicion every offering that Joe tendered in a two-month friendship campaign. Even the juicy chunks of raw fish which Joe fed Oscar were grudgingly accepted as due tribute and hastily gulped down without acknowledgment, courteous or otherwise.

Perhaps alligators just don't make friends, or possibly Oscar was congenitally misanthropic. At any rate the reptile's stubborn resistance to Joe's most cunning wiles was at once discouraging and challenging. The situation might have remained at stalemate indefinitely if Joe hadn't, quite accidentally, found the Achilles' heel of Oscar's up-to-then impervious, and seemingly schizophrenic, personality.

One morning while he was standing near the large bathtub in which Oscar lived with four smaller alligators, Joe

He was just another alligator—until the magic of music touched his soul. Musicians vied with one another for his recognition; but when he heard the sound of his own voice on a victrola and saw another animal of his kind, murder entered his heart

was idly fingering the long, slender, steel rods that hold together the soapstone ends of a large, glass-sided aquarium. Held taut by a turnbuckle arrangement, the rods were under considerable tension; and as Joe plucked them they vibrated, giving forth a deep thrumming sound. As the tone of the vibrating metal rod died slowly away there came from the depths of the bathtub an answering bellow. The voice was Oscar's,—the sound something midway between a cough and a roar. Startled into the greatest activity he ever displayed before or since, Joe hastened to my office and insisted that I verify his amazing discovery. It was easy to do. Each time the rods were "strummed" Oscar pointed his evil-looking snout toward the ceiling and uttered a blissful reply.

*The saga of
Oscar
the musical
gator*

The accidental discovery of his vocal accomplishments led to the decision that Oscar should be drafted as an experimental subject, for although alligator hunting is a fairly popular sport in some regions and the beasts are raised on "gator farms" in the South, there are many things that scientists do not know but would like to discover concerning the behavior of these large reptiles. In accordance with the prestige attached to Oscar's new status as a servant of science, he was transferred from the somewhat cramped quarters of the bathtub to a private tank some 29 inches wide and 17 feet long. We decided to give our newly discovered virtuoso a few days to become used to his new surroundings, and during the interval we spent many hours in the library searching through scientific and popular books and journals to learn what others had published concerning bellowing of alligators.

The results of our research were meager enough. Fancy outweighed fact, and anecdote was piled upon anecdote to build an intriguing but unconvincing body of mythical lore pertaining to the behavior of the alligator. As the grains of reliable evidence were sifted from the chaff of surmise and speculation, it soon became apparent that there was much to be discovered about the vocalizations of Oscar's tribe. Highly literary descriptions were abundant and impressive. For example, in 1791, Wil-

liam Barton, in his account entitled *Travels Through North and South Carolina, Georgia, East and West Florida*, described the bellowing alligator in the following words: "Behold him rushing forth from the flags and reeds. His enormous body swells. His plaited tail brandished high, floats upon the lake. The waters like a cataract descend from his opening jaws. Clouds of smoke issue from his dilated nostrils . . . the incredible loud and terrifying roar . . . most resembles very heavy distant thunder, not only shaking the air and waters, but causing the earth to tremble. . . . He now swells himself by drawing in wind and water through his mouth, which causes a loud sonorous rattling in the throat for near a minute, but it is immediately forced through his mouth and nostrils, with a loud noise, brandishing his tail in the air, and the vapor ascending from his nostrils like smoke."

Later observers have recorded their descriptions of the same phenomenon with diction less poetic but equally forceful. It seems to be generally agreed that the bellow of an adult bull "gator" is one of the loudest and most awe-inspiring sounds emitted by any living creature. Wild alligators usually roar while they are swimming slowly through the water. When air is drawn into the lungs the head is pointed upward at an acute angle and the center of the tail is raised so that it forms an arch, with the tip bending

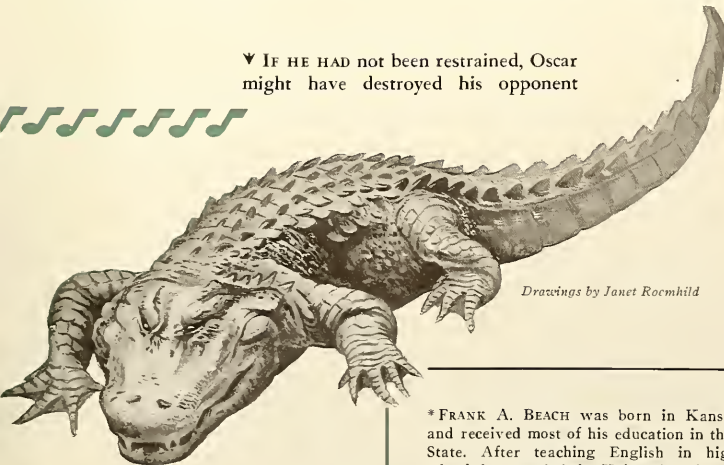
downward to touch the surface of the water. As he utters one roar after another the animal moves his tail from side to side, thus "sculling" himself along.

Although the evidence is far from conclusive, it is generally accepted that the bellow is emitted only by the male alligator; and in the dank, treacherous swamps of southeastern United States where the reptiles are found, bellowing is heard most frequently during the breeding season of late spring and early summer. These observations have led to various speculations as to the probable function of the vocalization. In the main, two interpretations have been proposed. According to one school of thought the bellow is a mating call, so sweet and entrancing to the female of the species that she is irresistibly drawn to the lusty singer. An opposing point of view holds that the roar of the male possesses no attraction for the female, but serves as an aggressive challenge to other males and constitutes a long-distance warning to all possible rivals who might approach the breeding spot and eventually compete for the favors of females in the vicinity.

We had little hope that experiments conducted in the laboratory with Oscar would throw any light upon the purpose of the alligator's bellow; but it seemed worth-while to discover what we could regarding the behavior during roaring and the types of stimuli which might call forth the response.

Starting with the sound which Joe, the zoophilic janitor, had found effective, we studied Oscar's reactions to the vibrating steel rod; and it quickly became apparent that our subject was somewhat of a critic, roaring nicely in response to some rhythms and refusing to reply to others. Plucking the rod rapidly at one-second intervals produced a steady volume of sound that seemed to irritate Oscar to the point of evoking a "hiss" now and

▼ IF HE HAD not been restrained, Oscar might have destroyed his opponent



Drawings by Janet Roemhild

By FRANK A. BEACH

Chairman and Curator, Department of
Animal Behavior,
The American Museum of Natural History

*FRANK A. BEACH was born in Kansas and received most of his education in that State. After teaching English in high school, he attended the University of Chicago as a Fellow in Psychology and earned the degree of Doctor of Philosophy. He worked for two years at Harvard as a research assistant in animal psychology and then came to the American Museum, where he has been in charge

of the Department of Animal Behavior since the death of Dr. G. K. Noble in 1941. Dr. Beach is particularly interested in the role of hormones and the nervous system in animal behavior and especially in the evolution of human behavior. He is a visiting Professor of Biology at New York University and a Lecturer at the Washington School of Psychiatry. —EDITOR.

then, but without calling forth the bellow. If the rod was plucked once a minute or less frequently, Oscar appeared oblivious to the sound; but when it was plucked once every 5 to 10 seconds and allowed to vibrate freely during the intervals, Oscar responded promptly. First his head was raised slowly and deliberately a few inches above the surface of the water; and next his body shifted so that he was pointed toward the source of the sound. Then, throwing his head farther upward and raising his tail slightly, he inflated his body until his sides strained and swelled under the effort of inhalation. Almost immediately thereafter his sides contracted spasmodically and the bellow was produced as the great volume of air was forced rapidly through his throat. Six to eight roars usually occurred in sequence, and with each successive roar Oscar's head was raised higher, so that after several roars it was at a sharp angle with the line of his back.

Occasionally when Oscar inhaled preparatory to roaring he emitted a short "hic" not unlike the involuntary vocalization of a bibulous gentleman. The subsequent exhalation produced a hoarse, moderately loud, deep note which suddenly increased tremendously in volume and rose in very sharp crescendo with a concomitant rise in pitch. After coming suddenly to its peak, the volume of sound died out slowly and the pitch fell simultaneously. Oscar's mouth was opened less than half an inch during the inhalation and the roar.

Upon several occasions Oscar was tested in dim light. Before the steel rod was plucked the vertical, slitlike pupil of his eye was always partially contracted; but after he had roared, it was invariably expanded to the maximum to form a broad oval. Now, contraction and relaxation of the pupil are controlled by the fibers of the sympathetic nervous system, and this system is known to be very active when animals or people are emotionally excited. His pupillary response thus suggested that roaring was accompanied by marked excitement, and there were many additional indications that the sound of the vibrating rod awoke strong emotions within Oscar's reptilian breast. Under ordinary conditions he was extremely lethargic, supremely indifferent to the comings and goings of laboratory attendants and to all other prosaic events incidental to normal laboratory routine.

But Oscar was a changeling. The instant the sound of the vibrating steel rod fell upon his ears he was transformed into a thing of swift and violent action,—a purposeful creature delicately and immediately sensitive to all changes in his environment. Sometimes when the rod was vibrated Oscar rushed splashing through the water to a point in the tank closest to the source of sound, and slashed his tail from side to side with mighty strokes, forceful enough to knock a man's feet from under him. Day after day when he was stimulated to roar, the alligator repeatedly tried to force himself up and over the side of his tank, and these attempts were always made at a point nearest the position of the vibrating rod.

In other tests Oscar varied his method of approach. Instead of rushing headlong toward the source of sound, he would adopt a distinctive posture and method of locomotion which gave a definite impression of menace and aggression. Rising as high as possible on all four legs, inflating his sides to their fullest extent, and carrying his head slightly lower than his body, he moved slowly, implacably, step by step toward the position of the vibrating rod. With mouth half open to expose a murderous set of teeth, Oscar advanced like an armored juggernaut bearing down relentlessly upon a cornered adversary.

The fact that in the majority of tests Oscar moved close to the position of the vibrating rod strongly indicated his ability not only to hear the sound but also to localize its source. To establish this ability beyond question we tested the alligator's responses when the rod was vibrated constantly while it was moved from one end of the tank to the other and back again. Under these conditions, although neither the rod nor the experimenter were within Oscar's field of vision, he paraded up and down the inside of his tank, following closely the invisible auditory stimulus and making repeated vigorous attempts to raise his body to the top of the tank wall. There was no doubt that he knew where the sound came from.

Having tested Oscar's reactions to the tones of the steel rod, we were anxious to employ other sources of sound as experimental stimuli. We seemed to have an excellent opportunity to determine the alligator's range of hearing as well as to discover exactly which notes would induce roar-

ing. For several reasons the rod was an unsuitable stimulus. Its pitch could be varied only two or three steps on the musical scale; the volume of sound it produced could be only crudely controlled; and, worst of all, it did not produce what is known as a pure tone. That is to say, the rod vibrated as a whole, throughout its entire length, producing its dominant or fundamental note. But at the same time it vibrated in halves and in quarters and possibly even in eighths; and each partial vibration produced a note of its own, a harmonic of the fundamental. Thus if the fundamental note produced by the vibration of the entire rod was C two octaves below middle C, the vibration of the separate halves of the bar gave rise simultaneously to the note C one octave below middle C; and quarter-length vibrations produced middle C. Under such conditions it was impossible to determine which of these various tones exerted the magnetic effect upon Oscar and caused him to utter his distinctly unmusical reply.

Our need was for an apparatus producing a pure tone, a fundamental without harmonics, which could be varied extensively in pitch, and which could be altered independently in volume. Such machines are commercially available but there was none in our laboratory stock room. They can be built, but during war time the necessary electronic equipment is unobtainable. Accordingly we regretfully relinquished our hopes of working with pure tones and cast about for some type of apparatus with which we could produce a wide range of tones, with varying volume. By comparing the sound of the vibrating rod with each note on the diatonic scale we determined that the fundamental note was approximately equal to B flat two octaves below middle C. This note, which seemed to have roughly the same pitch as Oscar's roar, is produced by 57 vibrations per second (written $57 \sim$). Accordingly we knew that our apparatus would have to produce tones at least as low as, and preferably lower than, $57 \sim$, and at the same time tones of much higher frequencies. For several weeks we sought in vain for a practical tone-producer.

At the time that our experiments were in progress the auditorium of the Museum was being used by a large orchestra for practice sessions and public concerts. At noon recess the

musicians frequently strolled about the hallway behind the auditorium chatting and relaxing tired muscles. A few of the more assiduous carried their instruments along and painstakingly ran over troublesome passages in the day's score. As I hurried through the hallway one noon I heard a sound that I immediately recognized as the answer to our search. To say that the tones resembled either a vibrating steel rod or an alligator's roar would be inaccurate as well as unkind, but the pitch and the rich tonal quality impressed me as exactly the type of sound that would appeal to Oscar. Seeking out the source of the music, I peered behind a crate of plaster-encased dinosaur bones and saw a pleasant looking gentleman blowing merrily away upon a French horn. Bracing myself for an indignant refusal, I asked him to come up to our laboratory and play a short concert for an alligator. To my delight the novelty of the situation caught the musician's fancy, and he willingly agreed to help us.

To make a long story short, the tones of the French horn fascinated Oscar beyond belief. He roared repeatedly when the concert B flat (two octaves below middle C) was blown at five-second intervals with a two-second rest after each note. If the same tone was sounded continuously, Oscar was unimpressed; and other tones with frequencies close to 57 ~ failed to evoke roaring. Upon a single occasion he roared in response to the first harmonic of 57 ~, namely B flat one octave below middle C (113 ~). Oscar was definitely a B flat alligator! His reactions to the concert B flat of the French horn were the same as those given to the vibrating steel rod. Accurate localizing behavior and dramatic evidence of emotional arousal were obvious in every test. Many tones that failed to evoke roaring did call forth other types of response, and it became evident that Oscar could hear sounds varying in frequency from 57 ~ to 341 ~. At neither extreme were the absolute limits of his auditory sensitivity reached.

The friendly French horn player related his experience to other musicians, and Oscar's reputation as a basso profundo spread like the proverbial wildfire through the orchestra. Two days later a cellist volunteered to spend his lunch hour playing for Oscar. Once again the alligator demonstrated his preference for B flat two

octaves below middle C, thereby forcing the cello player to tune his instrument lower than normal. When a 57 ~ tone sounded on the cello, Oscar roared at once; and since the tonal quality of the stringed instrument is quite different from that of a horn it was plain that pitch or frequency was the important factor.

Those who have observed alligators in the wild report that when one 'gator roars others are sure to reply. To test this theory we made a phonographic recording of Oscar's roar and then played the record beside his tank. His response was prompt and complete. Whipping the water into a foam with vicious slashes of his tail, he roared at full volume in reply to the recording of his own voice.

Since Oscar appeared to be highly excited when he was stimulated to roar, we were interested to learn how he would react to another alligator placed in his tank while roaring was in progress. Accordingly a second male slightly smaller than Oscar (no females were available) was put in Oscar's private tank and the French horn was blown. Before the stimulus tone was sounded Oscar appeared to be completely unaware of the other animal's presence. The two alligators moved freely and independently about the tank, occasionally crawling over one another without eliciting any response.

The French horn was blown when the males were at opposite ends of the 17-foot tank. When Oscar began to roar, the smaller male looked at him for a while and then began to move down the tank in Oscar's direction. There was no indication that the roaring frightened the new alligator; in fact, he seemed mildly curious about the strange performance. Some minutes after the echoes of the last roar died away the situation changed dramatically. Turning a baleful glare upon the intruder, Oscar raised his body as high as full extension of all four legs would permit and stalked stiffly toward the other male. Head low, jaws agape, and sides swollen to increase his girth, he was the very personification of menace; and so he must have appeared to his opponent. The smaller reptile, halting his innocent investigatory approach, began a slow retreat, which soon deteriorated into a rout as he whirled about with a great splash and made full speed for the far end of the tank.

Oscar's advance neither faltered

nor quickened. Apparently scornful of his adversary's frantic attempts to escape, he closed in ponderously but with deadly efficiency. As the distance between them narrowed, the smaller alligator thrashed his tail wildly and tried to climb up the tank sides. Oscar halted at a strategically safe distance until the flurry died down and then moved in for the kill.

Having failed to anticipate either the immediacy or the viciousness of Oscar's response, we were quite unprepared to deal promptly with the situation our experimentation had precipitated. Neither 'gator was large enough to deal a man a mortal wound; but both were obviously very much aroused, and the bite of even a four- or five-foot specimen would undoubtedly be painful, to state the case mildly. Sending an assistant for a rope or stout stick to restrain the animals, I continued to observe their behavior. Frantically and very unwisely the smaller male made a dash to escape, trying to slip past his aggressor before an attack could be launched. Like an old campaigner, Oscar let his victim's head and neck slide past to avoid possible counter-attack; then he struck, seizing a forelimb in his powerful jaws. As the younger animal pulled free, Oscar shifted to a new grip across the back and finally to the tail. The smaller male finally broke and fled, with Oscar in full pursuit. At this point the assistant arrived on the scene with a board, which we used to hold Oscar at bay while the smaller animal was removed. Fortunately the alligator's thick scales are very effective armor, and no serious damage had been done; but if the one-sided battle had continued Oscar might well have wounded his enemy severely.

Results obtained with captive animals always have to be checked against observations made in the field, but Oscar's behavior toward another alligator suggests to us that bellowing by wild 'gators is probably associated with fighting between males. Whether or not it also serves to attract the female, only further experiments can determine.

When our tests were concluded we set Oscar aside, planning to examine him again after the war when more accurate sound producers would be available. Unfortunately he soon fell prey to some obscure ailment and, after a brief illness, he died, thus writing *Finis* to the Saga of Oscar the Musical 'Gator.

BE IT EVER SO HU

By HARRY
Curator and Chairman, De-
partment of The American Museum

ESPECIALLY impressive among the many interesting collections of the American Museum of Natural History is a large assortment of models illustrating the various types of houses built by primitive man throughout the world. This article is based on this collection.

In the Museum, the models are scattered through many halls; here a selection of the most significant ones is gathered together for the first time as a unit for study and comparison. Some of the models are portable and are circulated among schools along with other exhibits, by the Museum's Department of Education. Others are life-size replicas.

The scientific care with which they have been constructed can be understood from the fact that in many instances several years of study in a single group of people have preceded the actual construction of one of the models. The more elaborate ones required months of work by skilled technicians. The collection as a whole is probably the finest and largest in the world.—ED.

As thoughts turn more than ever
it is astonishing to discover how
around the world have followe

▼ PORTABILITY is again a vital factor for the Indian. But even where life depends on game, the house provides more than shelter. It affords privacy from the world and unites the family in mutual endeavor.

ALL PHOTOS A.M.N.H.

▼ NEAR THE TIP of South America we find the simplest of dwellings, a crude windbreak that serves as the only shelter for the Ona family in a chilly and windy climate. Being nomadic, the Onas must be able to carry their shelter with them in their wanderings in search of food. Six to sixteen skins of the guanaco, a relative of the llama, are used in one of these windbreaks. The hair is scraped off, and the skins are smeared with grease and red ochre



MMBLE

J. SHAPIRO

Department of Anthropology,
University of Natural History

I
to other lands and other climes,
many curious patterns people
in making themselves a home

ture of the tepee of the Plains
on frequent movement in search
in mere protection from the ele-
ment of community life and



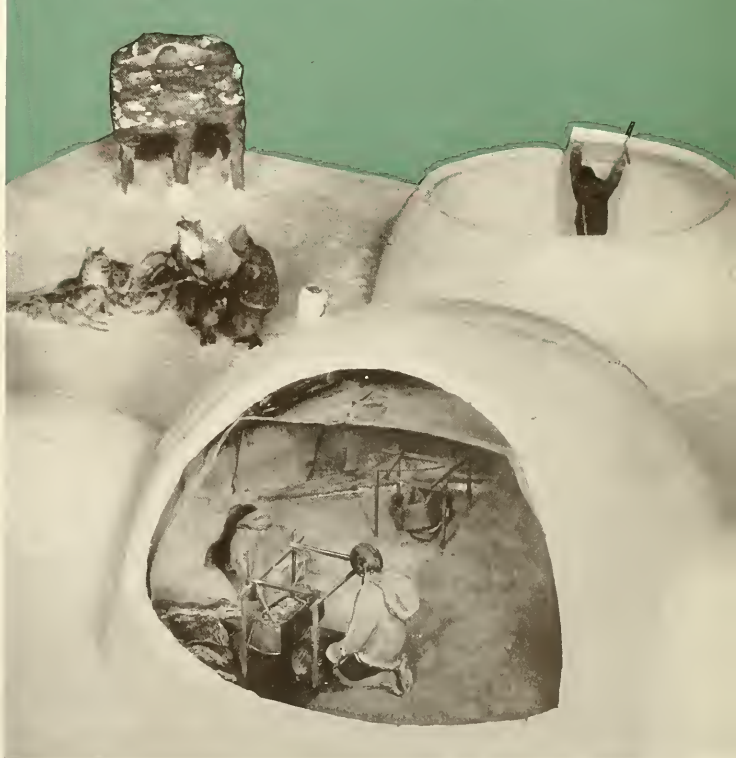
IT IS NECESSARY, I suppose, if we are to get on with our daily tasks, for most of us to take for granted the paraphernalia, frequently ingenious, by which the human organism maintains its comfort and extends its powers. Yet it is a source of wonder how nicely every tool, every item of gear and equipment, every article of clothing represents an extension of the human body and its needs, and usually reveals a history of increasing adaptation and efficiency.

The house illustrates this principle perhaps as well as any other object of man's material culture. But in one respect the house is probably unique. All other inventions and artificial devices of human culture originate exclusively in *human* experience. Even

the rudest tools known to us are human inventions. No animal, not even the anthropoid ape, has ever been known to chip a stone with deliberate intent to fashion a tool. They may use a stick, a stone, or even a coconut as a ready-made device, but they do not transform the raw product into something new by conscious and purposeful effort. Thus none of our gear, even in its most primitive forms, has any prototype among the subhuman animals.

The house, however, is the only exception to this rule. Its counterpart is widespread in the animal kingdom in the form of nests, shelters, hives, and various other artificial structures. And it is as truly an artifact as anything in man's equipment.

▼ THE ESKIMO snow house, perhaps more than any other dwelling, illustrates how a house surrounds its occupants with an artificial climate in which greater comfort, sometimes survival itself, is possible. The colder it gets outside, the warmer can the Eskimo heat his snow hut without weakening the walls. The interior can be kept well above freezing by burning the seal oil lamp, particularly if skins are pegged to the walls to form an insulating layer of dead air





▲ PEOPLE of the old Stone Age found shelter in natural caves and rock crevices. If they developed any sort of domestic architecture beyond the most elementary use of branches and leaves, all traces have been destroyed by time. This model, recently completed in the American Museum, shows human life about 500,000 or 600,000 years ago on the Somme River in France. (Chellean Culture)

▼ MAN'S EARLIEST HOME, the cave or natural rock shelter, has also been used down to recent times by some peoples. Here is reconstructed a cave near Armonk, New York, which was occupied by Indians at the time when this continent

first felt the influence of European culture. The same cave had been inhabited at a much earlier period as well, by a different people, who made tools and weapons only from stone and bone, and were ignorant of pottery



THE precise evolution of the human habitation from its simplest precursors is difficult, if not impossible, to unravel. Primitive man, who often lived in caves where these were available, has thus far not provided us with any remains of his more ephemeral efforts to provide shelter for himself. The chances are that we shall never find any such traces, since the earliest representatives of mankind could have used only perishable materials for such structures. In all likelihood primitive shelters were of the crudest character, only little advanced beyond the nests that the anthropoid apes construct for themselves in the branches of trees.

Some writers have assumed that the origin of the house goes back to the use of caves, and that the evolution of masonry and stone construction arose out of the efforts of the

cave dwellers to close the openings of their shelters with walls. This sequence, however, seems more fanciful than real. In the first place, primitive man probably inherited from his primate ancestors a tradition of nest building that he could easily adapt to his needs. Furthermore, masonry is by no means universal, and where it does occur it appears to be relatively late rather than early in the history of the house. In Europe, for example, remains of wattle and daub houses found as far back as the Neolithic antedate evidence of the use of stone construction.

In any event, it seems most likely that the house went through multiple lines of development, according to circumstances, rather than a single evolutionary sequence. It is more accurate to conceive of its development as varying among diverse peoples, taking directions that material, environment, and skill suggested. In

some instances, indeed, little or no progress whatever can be detected, with the result that at present almost every stage of complexity may be seen in the contemporary housing of mankind. Men live in caves today, as they did 50,000 years ago. Windbreaks of the simplest construction serve now as they have in all stages of human history. This very multiplicity of house types found throughout the world leaves no doubt that the human habitation has had a complex history of development and adaptation.

The variety of house types in use brings to mind the old French saying, "*Plus ça change, plus c'est la même chose*"—the more it changes, the more it remains the same thing. The diversity of domiciliary styles should not mask for us the fact that the basic needs a house is designed to satisfy are constant necessities which all forms of habitation serve with more or less efficiency and elegance.

storage

▼ GROWTH OF THE HOME beyond the limit of a single room was stimulated largely by the need of storage space for food, implements, and other goods. In this model of a Koryak village on the seacoast of

eastern Siberia we see a small shed for such properties (*center foreground*). At extreme left is a storeroom on a platform for protecting winter provisions. It is elevated to keep the food from dogs and wild animals



storage



▲ A CORN CRIB constructed of cane illustrates the necessity for the storage of food among agricultural natives even on a relatively low stage of culture. This is a reconstruction of a Natchez Indian community in eastern central United

States. The conical roofs of both the hut and the storage chamber are of matting. The "pyramid" in the distance, known through archeological excavations, presumably had some role in the spiritual life of these Indians

THE fundamental needs that a house must fulfill are simple and universal. A house or shelter must provide protection from the weather, from cold and snow in cold climates, from heat and rain in warmer ones. In a very real sense, the house surrounds its inhabitants with an artificial climate in which greater comfort is possible, and upon which, in certain severe circumstances, existence itself depends. The human organism by itself is not able to meet all the rigors of the weather. The natural protection that other animals have in pelt, hide, and fatty deposits is inadequate in man, who seems to have evolved in a warm climate where such anatomical accessories were unnecessary. But since he has ventured into every corner of the earth, into regions for which he was not adapted by nature, he has been

forced to acquire an artificial protective device—the house. Indeed, one might argue that only the development of some form of shelter made possible the world-wide distribution of mankind that we see at present.

Aside from the physical shelter that a house provides, it also serves another universal need, the protection and storage of personal property. Although primitive man had few possessions and perhaps little need for storage unless he were fortunate to have an excess of game, man in his cultural advance soon began to acquire accouterments essential for his way of life and ornamental to it. These impedimenta, the personal assets we all treasure, must be kept and stored; they must be housed where they can be found when wanted; they must be set apart from the community

property. If shelters and houses were not needed for man's physical well being, they would still be necessary to contain his equipment.

Indeed, when storage comes to occupy too large a space in the dwelling, man begins to build special houses to accommodate it. Food storage, especially in agricultural communities, requires this special housing, and in hunting groups such as the Eskimos special rooms or bays are built solely to accommodate reserve food and gear. Even in highly complex societies, like our own, this primary function of the house has remained intact, although with the necessity for large-scale storage of various commodities, special independent structures like warehouses and barns have evolved out of a province that once belonged exclusively to the house.

home as a refuge

To these basic requirements of the generic house may be added a less tangible attribute. The house or home represents a haven and a refuge. It provides an oasis of privacy in the midst of the publicity of community life. To have a room of one's own, a sanctuary, is a profound and common need. The child who discovers a secret cave where no one can find him, or builds for himself in the backyard a little shelter out of a packing case and stray lumber, into which he can retire as into a private world, reflects a profoundly human craving. It would be difficult, however, to determine whether such a feeling leads to building a house or follows from the possession of one.

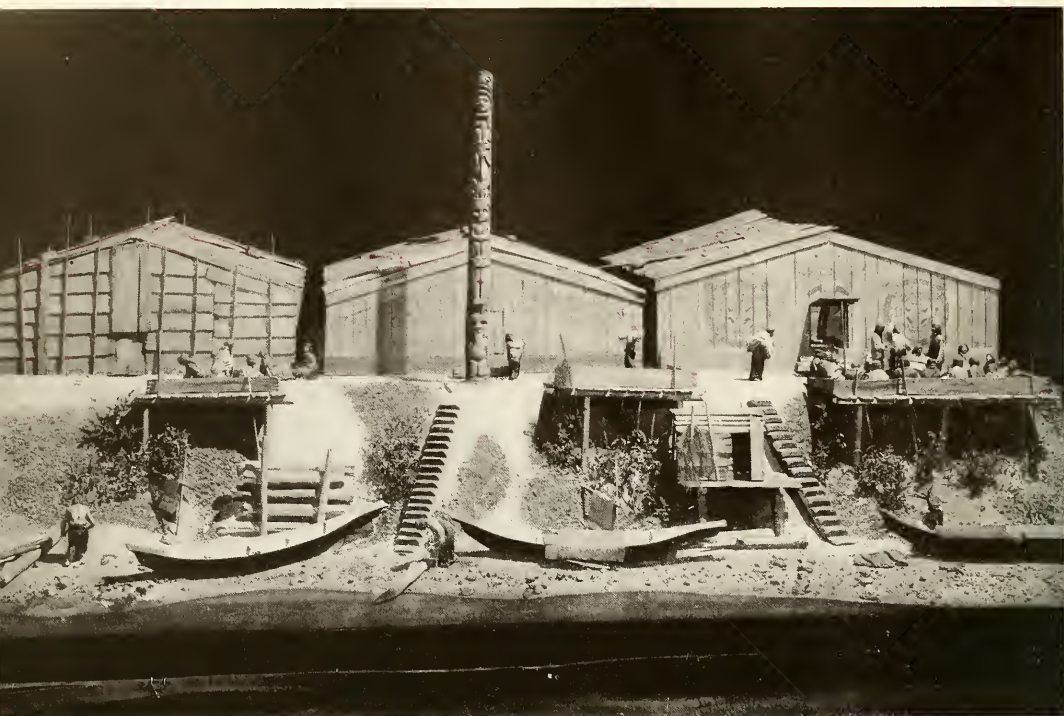
► EVEN IN THE PRIMITIVE COMMUNITY, where each family seldom has more than one room, the home is a refuge and a haven, satisfying the human yearning for privacy. A Blackfoot tepee



▼ PRIVATE SLEEPING COMPARTMENTS provided seclusion in the earth-covered lodge of the Hidatsa Indians of North Dakota. The frame of one of these compartments without its skin covering is shown at lower right. One side of the lodge has been cut away in this model to

show the interior. The only openings in such a house are the door and the smoke hole in the roof. Houses of similar construction were used by most of the semi-agricultural Indians of the Plains. The tepee was their temporary dwelling





▲ WHETHER ON AMERICA'S north-west coast as shown in this photograph, or elsewhere in the world, the plank-built house follows a certain general pattern. This is a village scene among the Kwakiutl Indians, reconstructed in miniature as an exhibit in the American Museum. Heavy cedar posts support the plank roof. In the older type of house (*at left*) the walls were made of overlapping planks tied to upright poles. The houses face the sea, and there are platforms in front on which the Indians pass much of the time in fair weather. These houses are decorated with elaborate carvings and paintings expressing mythological and totemic beliefs of the tribe

▼ USE OF GRASS as house-building material, widespread throughout tropical and some temperate regions, naturally imposes an architectural style quite different from that of the plank house. This is a model of a Congo hut



ALTHOUGH, as we have seen, the house has come into existence to serve simple and universal physical necessities, it has nevertheless acquired a vast and fascinating variety of forms, materials, and constructions: There seem to be almost as many kinds of houses as there are styles of clothing. Leaving out of consideration the complex houses of civilized man, I shall attempt to indicate the range of this diversity as it exists in the domestic architecture of the simpler cultures. And I shall try to indicate some of the factors and circumstances that dictate this variation.

What is it, one may ask, that has brought about the multiplicity of domiciles even among people on a relatively simple level of culture, if, indeed, the house is basically designed to serve such universally shared necessities as shelter, storage, and privacy? Moreover, if these needs are determining factors, why do the various forms of habitation not fall into a simple progressive line of increasingly perfect accommodation to them? There is no single answer to these questions, largely because these needs vary in their intensity and because the environments in which man lives are diverse. Moreover, numerous solutions are sometimes equally satisfactory even under uniform conditions. And finally, the creator of a house is a social creature, subject to a variety of influences emanating from tradition, knowledge, taste, and mode of life, which he embodies in all that he creates. It follows, therefore, that while the fundamental incentives to house building may be reduced to a few, the expressions to which they give rise may be and are many.

The material of which a house is constructed not only lends its character to the appearance and purpose of the structure, but it often dictates the method of construction. It is obvious that the use of planks and boards demands a framing quite different from the palm house. Furthermore, shapes that are feasible in one material are awkward in another. The circular, domed or conical forms, which are readily constructed out of fibers, leaves, grasses, or mud-covered wicker frames, are unsuited for wooden construction.

BE IT EVER SO HUMBLE



▲ DEEP IN THE ITURI FOREST in Africa, the pygmy builds a small beehive hut of broad leaves. It sheds rain well but is tiny even for the diminutive people who build it. The hunter has just returned successful. As a result the hunting dog has been permitted to wear his wooden bell

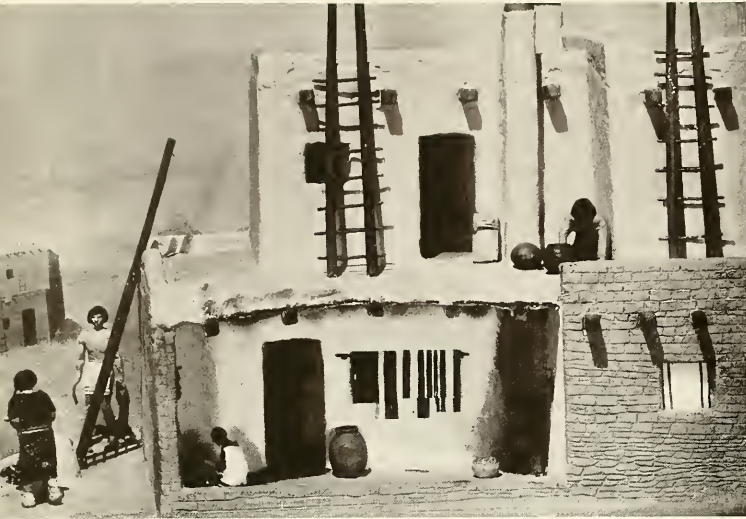


▲ A CUT-AWAY SECTION of a model of a bark hut of the Ojibway Indians. It shows one of the basic patterns for a light but strong dwelling built in the shape of a dome from materials widely available

—many different

stone and mud

◀ STONE AND SUN-DRIED BRICK, generally whitened with gypsum, are used in the construction of the compact Hopi village clusters. The women take an unusually active part in house-building, but the men are apt to lift into place the heavy beams, whose ends are seen projecting through the masonry in rows. The roofs are of cross poles, brush, and clay. Many of the rooms in the lower terrace are for storage



wattle and daub

► THATCH-COVERED wattle and daub houses like this are seen in various parts of Europe today, yet this is a model of a Neolithic house that was used in Denmark in about 2700 B.C.



materials—

MAN has shown a remarkable ingenuity in his use of natural materials for building his shelters. He has employed stone, coral, brick (often in the form of sun-dried or adobe blocks), plaster, cement, mud, dung; loose, rammed, or root-bound earth; logs, planks, branches, vines, bark, leaves, reeds, grasses, skin, felt, mats, and even snow.

thatch and wattle



▲ THATCHING was tied over a frame like that of the Ojibway bark hut (shown previously) in the dwelling of the Shinnecock Indians of Long Island. Overlapping layers like this are remarkably effective in shedding rain



snow

◀ THE ESKIMOS build their snow huts by a totally different principle than that of other dome-shaped dwellings seen throughout the world. The blocks of snow are laid in a spiral. As the wall slopes inward toward the top each new block is supported by the one next to it. The Eskimo must travel light and is obliged to live at some seasons on the floating ice of the sea, where other materials are not available. His unique dwelling gives striking evidence that necessity is the mother of invention. It can be built in an hour, and all the builder needs is a snow-knife



skins

◀ SNOW HOUSES MELT with the approach of the warmer season, and the central Eskimos then live in skin tents. The poles are usually of drift-wood

many different materials



birchbark

◀ THE INDIANS of the Eastern Woodlands constructed a conical tent of birchbark almost the same in pattern as the skin-covered tepee of the Plains

logs

▼ THE LOG CABIN was originally neither Indian nor English. The idea was introduced by the Swedes who settled on Delaware Bay in 1638. The Indians of the South took it over and soon forgot they had ever lived in any other kind of shelter. This example is from the Yuchi Indians of Georgia. The log cabins built by the Indians had no chimney, only a smoke hole in the roof



protection from . . .

It is difficult to generalize for all types of houses, but the environment generally guides the choice of material. This doesn't mean that building materials are uniform in similar environmental areas, although broad similarities do exist. It is rather that the environment tends to discourage the use of unsuitable stuff when more efficient material is at hand.

I may illustrate this by pointing out that in cold areas non-insulating materials are highly unsatisfactory, so that such climatic conditions tend

to rule out at once the mat houses of the Philippines and the grass houses of Africa and South America.

This certainly is the tendency, although I must at the same time recall that the birchbark lodge of the Northeastern Indians and the lightly constructed Japanese house are not particularly well adapted to their environments. Perhaps stoicism and tradition in these cases rise superior to the discomforts of the weather. Conversely, in the hot moist climates, a

heavily constructed and insulated house is less desirable than one of light construction with walls permeable to currents of air. As a result, not universal by any means, the tropic dwellers tend to build with grasses, palms, leaves, and other materials that permit ventilation while providing shelter from sun and rain.

Hot dry climates, on the contrary, call for thick walls, and again we see in the adobe house of the Southwest the selective power of the *milieu*.

cold

➤ MANY PEOPLE living in the Arctic build houses that are partly underground as protection from the low temperatures of winter. The example shown here is from the Maritime Koryak of eastern Siberia. A long passageway leads into the house, but in winter this is closed off and the house is entered through the smoke hole in the roof. The smoke hole is protected from drifting snow by a funnel-like platform. People in cold climates frequently sleep on platforms, because the warmer air rises



humidity

◀ ON THE TROPICAL HEADWATERS of the Amazon in northern Peru, the Chama Indians live in houses that are open on all sides to assure maximum ventilation in a hot climate. The roof sheds rain well but is also porous to air. These Indians do not sleep in a hammock like many others in the Amazon but upon mats spread on the floor. The house furniture is simple, but they strive to beautify everything they make

WELCOME SHADE is found under this flat-topped shelter of the Apache Indians. Rain is no great problem here on the arid plain near the San Carlos River in Arizona, so a flat roof is as good as a sloping one. In summer much time is passed by these Indians under this shelter, which is open to the breeze on two sides. For many generations the Indians have cultivated their fields of corn in this valley. The woman at left is applying melted pitch to a water basket; the man is making arrows

protection

the



rain

◀ SLOPING ROOFS OF THATCH, generally porous but water-tight, are characteristic of native houses in the tropics. So are raised floors and well-ventilated foundations. These and other typical aspects of life in the tropics are illustrated here in a model of a village in the Philippine Islands

from
sun

▼ THE FLAT ROOF OF DESERT REGIONS is seen again in this view of a model of the ancient city of Ur. So far as architecture is concerned, the climate here at the confluence of the Tigris and Euphrates is the same as that where the Apaches live—hot sun, dry air, and only slight rainfall. The flat roofs and mud construction, still predominant in the Near East today, would not withstand heavy rain. But they are admirably effective in dry climates where shade makes the difference between scorching heat and pleasant coolness



▼ LIVING IN THE SWAMPY EVERGLADES of Florida, the Seminoles have developed a house that gives the maximum protection against the effects of dampness below as well as above. Raised on posts and sheltered with thatching against the rain, the living quarters remain open to the drying breezes and thus are light and airy.

damp earth

Numerous other illustrations of primitive architecture will be presented in the concluding section of this article in the next issue of NATURAL HISTORY





▲ FEW VISITORS to Buenaventura realize that the city lies at the base of the western cordillera of the Andes. On rare occasions, however, the cloud pall parts, the mists drift down the valleys, and the beautiful crest comes into view

Waterspouts, "pistol shrimps," and the unending wonders of the tropical forest figure in the further adventures of the "Askoy" Expedition along South America's least known sea coast

[[THE SIXTH INSTALLMENT IN THE
STORY OF THE "ASKOY" EXPEDITION]]

Mountain and Sea in the Chocó

By ROBERT CUSHMAN MURPHY

*Chairman, Department of Birds,
The American Museum of Natural History*



▲ BUENAVENTURA'S WATER FRONT, with "Askoy" at her anchorage off the Hotel Estacion. The length of the building piles is necessitated by the great tidal rise at the port

ON March 3 we left Piñas Bay for the next lap of our leisurely and roundabout voyage toward Point Santa Elena. We then learned rapidly that the standard weather conditions, described in an earlier article, can be altered locally and transiently by almost any shift of wind. When the dry trade wind, for example, was interrupted by a breeze from the south—that is, from the direction of the winter sun—there were always likely to be thundersqualls.

The complicated interrelations of steep coastal mountains and sea winds were illustrated particularly between

the Gulf of Panama and Cape Corrientes. When we set our course southward from Piñas Bay, in the heart of the "north-wind season," the morning breeze was actually blowing from west of south, so that we were at first able to hold a starboard tack parallel with the shore. Off Point Jaqué, however, it veered around to the southeast in no more time than is needed to tell about it, and took all our sails on the other side with a tremendous puff. This trend was then progressive so that within an hour the wind was back in the north, or astern, blowing half

a gale through the middle part of the day. About six bells in the afternoon it slackened somewhat, and within five minutes it had changed to due south! Long blades of spray then began to blow backward from the waves that had been kicked up by the preceding north wind, but 20 minutes later it was once again back in that quarter, which was "normal" for the season.

I mention these vagaries for the purpose of pointing out that they were strictly sea-level phenomena. All day long the scattered cumulus clouds at altitudes only a little higher than the

ridge of the coastal hills, or not more than about 1500 feet, were drifting swiftly and steadily toward the north. The procession was especially impressive during moments when violent northerly gusts were lashing the water white around our schooner.

Farther offshore the weather of the trade-wind season was more consistent, but here we often encountered demonstrations of the familiar conflict between sea and swell. Near Station 70, on March 30, for instance, the waves raised by the trade wind were bucking a larger and longer swell from the southwest. Consequently a rapid series of rollers from one direction was meeting and riding through a slower and higher series from another. The effect, from time to time, was to pile a watery Pelion upon Ossa and to give the illusion of shrinking the usual diameter of the horizon visible from deck. It was evident, furthermore, that when two waves met full tilt, crest to crest, neither was necessarily annihilated. On the contrary, they sometimes passed through each other, like ghosts in collision, and continued their separate ways undiminished.

Waterspouts were another entertainment sometimes met with toward



▼ A HILLY BUSINESS STREET IN BUENAVENTURA. This city, now one of the busiest ports on the west coast of South America, has docks like those of the Canal Zone and much other modern equipment on its water front. Elsewhere, however, Buenaventura hardly matches such beautiful Colombian cities as Bogotá, Cali, and Medellín



the offshore edge of the littoral zone, just before one of our seaward courses had carried us into peaceful and uniform conditions of the blue high Pacific. Our closest approach to one was on March 9, near Station 36. Soon after breakfast extraordinarily dark clouds thickened over the horizon in several directions, and presently we saw the tapered, gently swaying trunk two or three miles abeam. A cold squally wind blew at the same time out of the northwest, bringing rain that felt pleasant on the skin of our nearly bare bodies. The tip of the waterspout gradually stretched downward until it touched a surface fountaining up to meet it. The whirling funnel above broadened and blackened until a curtain of outer cloud veiled it.



▲ **LOW TIDE** in the boat basin at Buenaventura, where inland sailors meet those who have come up the estuary from the Pacific. The clinker-built boat on the right is equipped with outriggers of balsa logs

For this reason we never saw whither it traveled or whether it broke, but within half an hour a succession of swells raced across the otherwise quiet ocean and at the same time the needle of our barograph, which ordinarily traced an exceedingly monotonous curve through the daily march of atmospheric pressures, gave a little upward jump that made an unprecedented kink in its tracing.

A tropical climate favors the cheerful acceptance of rain at sea. We had a plentiful supply of oilskins on board "Askoy," but they proved so insufferably hot that most of us soon came to regard shorts and sneakers as proper rain garb. A shirt, or even a cotton jacket, might be useful under the midday sun, but when the skies opened, a single garment with nothing in its pockets was preferable. And then, as Doctor Beebe once pointed out, comfort and peace of mind arrived only after no single dry spot remained on one's person. When you couldn't get any wetter, you were content.

More noteworthy was the permanent conditioning to rain that we found among meticulously dressed human beings in such a damp community as Buenaventura. There an umbrella was part of the matter-of-course equipment of anyone who wore a necktie. Nevertheless, nobody on the street ever seemed to quicken pace when a

shower started, even if his umbrella had been left at home. Fashionably clad but dripping ladies continued to stroll calmly on toward their destinations. Everybody took getting soaked for granted; everybody was used to donning fresh clothes any number of times. Comandante Fallon left us after dinner in our hotel, on May 9, without stopping to consider whether the deluge of the moment would cease within five minutes or continue all night. He merely deposited his naval cap and epaulettes in my closet and sloped unhurriedly home in white shirt, white trousers, white socks, and white shoes. When everything one wore had to be changed twice a day, even in dry weather, why worry about rain?

Another experience of our cruise has left a memory which no one on board will ever forget, namely, the "meeting of the waters" at the end of the Ecuadorian rainy season. After crossing the Bay of Manta on April 14, northward bound, we approached the coast off the Cojimies River and saw ahead a great aggregation of migrant Franklin's gulls and other sea birds feeding over rich feeding ground. When we drew near, we

found that the birds had gathered along a clean-cut border between the transparent and azure offshore water and the turbid and yellow water from rivers in spate. Mixing was meeting the resistance to be expected in the case of fluids of such different densities, but the lighter and fresher water, which was filled with flotsam, appeared to be slowly flowing over the layer of saltier water. Starting at a point six miles from the coast, we drove "Askoy" along the sharp but turbulent line of demarcation while I swung the motion picture camera



(Below and right) **STRANGE CRAFT**, propelled by paddles, sails, or both, and equipped in some instances with living quarters for long river voyages, bring produce to Buenaventura. Here are corn and fruit and fish in the boat basin. The craft with a sail has a fisherman's net drying on her bowsprit



first to one side of the bowsprit, then to the other, obtaining what has proved to be a vivid Kodachrome record of the contrast which, even on the screen, makes a somewhat breathtaking spectacle.

Glimpses beneath the surface

The bulk of the collections taken on the "Askoy" Expedition came out of ocean water. For capturing our specimens, which ranged in size from large fishes to microscopic organisms, we employed everything from harpoons, seines, and dredges to the plankton-samplers described in an earlier part of this account. Our collection of fishes has already been reported upon in a scientific journal.¹ The publication deals with 132 distinct forms, representing 65 families, including three kinds new to science. More important is the fact that our investigations enabled us to extend the recorded distributions of 50 species of tropical fishes southward beyond their previously known ranges, and thus to throw new light on an understanding of the distinctive biological environment in the Panama Bight.

It was, however, the seemingly endless variety of invertebrates, collected and scrupulously preserved by the labors of John Armstrong, that made up the bulk of our zoological treasure. Not counting the minute organisms taken in hauls of silk nets, we obtained about 6000 specimens of marine invertebrates, most of which still remain to be studied after Lieutenant Armstrong and his fellow specialists have been able to resume the happy tasks of peace.

It would be hopeless to attempt a detailed account of the wealth and beauty of invertebrates gathered from the intertidal zone, the muddy or sandy bottom of the sea, or the infinite hiding places among coral gardens. Sometimes when we were dredging or diving, the pans and washtubs on the deck of "Askoy" would quickly fill with crustaceans of many kinds, octopuses, squids, shelled mollusks, holothurians, echinoderms, gorgonians (animals that imitate plants), pink corallines (plants that imitate animals), and much else. The hauls from 20 fathoms or more brought up strange fish as well, including scorpion-fishes, stargazers, goggle-eyed gobies, toad-fishes, flounders,

soles, and snake-eels as thin as a lead pencil but three or four times as long. Perhaps the commonest of all catches in the dredge were more or less frog-shaped crabs, appropriately called ranids, which when hoisted out of their element always looked pathetically like drowning sailors tossing up their arms.

Aside from some of the luminescent animals that I have described, the most spectacular among all of Armstrong's pets were the snapping, or pistol, shrimps. When he first demonstrated the parlor trick of these insignificant-looking crustaceans, I was astounded. An inch or so long, they possess a pogo, or it might be better to say "blank cartridge," in their somewhat lobster-like claws. Armstrong carried one fresh from its under-water hiding place into the laboratory of "Askoy" and dropped it into a beaker of sea water. The shrimp then snapped, making a sound as though some one had broken the glass container with a hammer. It could be heard like the crack of a pistol all over the ship. Repetitions of the report were as mysterious as the first one, however, because I was never able to see what I was told took place, namely a snapping of the "thumb," by some sort of trigger release, against the "palm" of the big claw. At the Bay of Málaga, a few miles north of Buenaventura, we found a wall of rock filled with tiny tunnels and chambers occupied by pistol shrimps that could have been reached only by using a sledge hammer. The slightest scratch on the face of their fortress, however, was sufficient to start off a tattoo of their queer response, which sounded like a far-away burst of machine gun fire.

Another memorable performance among many staged by the invertebrates was a nocturnal swarming of luminous marine worms at our nearly landlocked anchorage in the Ensenada de Guayabo Chiquito, in southern Darien. Thousands of the frantically active little beings suddenly darted up from black depths to contort and whip about like steel springs. With the discharge of their eggs and sperms into the water, they burst into strings of blue sparks. Beneath them voracious fish, which we could discern dimly in the light thrown out by the victims, assembled to take toll of the worms at the very moment of their mating and reproduction. The date was May 21, five days before new moon, which

ties up the period of the month with the performance of the edible palolo of Polynesia, most famous among sea worms. The palolo swarms in October but always, with clocklike precision, in the last quarter of the moon. Incidentally, May at Guayabo, in the northern tropics, is not far out of seasonal correspondence with October at Samoa, in the southern tropics.

Certain fishes also have breeding periods synchronized with lunar phases, through the intermediate influence of the tide. Our observations at Gorgona Island throw light, perhaps, upon an historical incident of more than four centuries earlier. It is recorded in the chronicles that when Francisco Pizarro and a handful of comrades were marooned on Gorgona in 1527, the hungry Spaniards were able to capture along the beaches of the island, on a night following the full moon, as many pearly fishes as they could use. The same opportunity holds today, and the fish is the *aguja*, or needle-fish, examples of which we acquired from a Colombian fisherman at Gorgona. The needle-fish have large eggs, covered with mucilaginous filaments which cause them to stick readily to sand. They have a tide-line breeding habit, like the famous grunion of California, and on nights of spring tides they turn the water's edge into flashing silver as they struggle toward the highest limit of the flood.

High coasts and low

In the Panama Bight each section of coast, whether forested or half-open, whether steep and dry or low and wet at the season of our visit, had its own charm and its own reward. The Baudó Mountain shore, however, offered at least one advantage over others, namely, its accessibility. Here we found plenty of depth beneath our keel, sometimes within a stone's throw of breaking waves, as well as a succession of roadsteads or coves in which "Askoy" might lie securely at anchor. The low coast, on the other hand, straight-armed us far from land because of the long slope of the silty bottom and the bars across the river mouths, and because the troublesome rollers sometimes began to drag over shallows when they were still miles at sea. At only three points of the perpetually rainy Chocó did we succeed in passing inland through the coastline, these being at Buenaventura, the Bay of Málaga, and the delta of the River San Juan. What we saw on

¹J. T. Nichols and R. C. Murphy, Bulletin of the American Museum of Natural History, vol. 83, 1944, pp. 217-260.



◀ A CANOPY of man-o'-war birds, a familiar sight in the neighborhood of many wooded islets off the Chocó coast. The examples that are wholly black silhouettes are males, whereas the adult females reveal the pure white feathering of their necks and breasts

➤ MIGHTY BREAKERS make landing difficult on the beach at Cocalito, Panama, even when the Pacific is otherwise calm. Because of cliffy shores to the north and the south, with miles of trackless rain forest behind them, the waves guard the Chocó Indian settlement at Cocalito against visitors from the outside world



▼ THE MOUTH of the River Coredó, where its waters spread over the broad bar of the harbor known on some maps as Humboldt Bay



◀ THREE RACES at the Ensenada de Coredó: two Chocó Indians, Comandante Eduardo Fallon (who represented the Colombian Government on the "Askoy" Expedition), and two negroid boys of mixed blood



▼ THE LARGEST *cocal* or coconut plantation seen during the "Askoy" Expedition lay for two miles along the shore of the Ensenada de Coredó, north of Point Marzo



▼ A FIELD OF CORN planted on land recently cleared of forest on the banks of the River Coredó, a mile above its mouth



these occasions determined me to plan a third and final visit to the Chocó, on which I shall forsake the open ocean and confine my wanderings to streams, *esteros*, and backwashes of the country by means of such river steamers as ply regular routes and by native dugouts propelled by outboard motor or paddles.

The mangrove forest about the mouth of the San Juan was different in appearance, for example, from any of the similar groves we found at the heads of bays in the mountainous coast. It seemed more open and more magnificent, with spacious aisles between the bulbous bases and arched roots of the trees and it was covered with a soft green carpet of ground plants. The hour of the day in which I saw it briefly on May 3, may have had something to do with its extraordinary appeal. Late and slanting rays of the sun were then sending beams into dim corridors under the lowest level of mangrove boughs, and the vista was as quiet as a dream except for a pervading seashell murmur from dancing breakers to the west. The woods appeared at that moment like the apotheosis of a Hellenic grove, out of which one might almost expect centaurs to come prancing.

Our visits to the lonely ports between Piñas Bay and Cape Corrientes were made on both the southward and the homeward voyages in "Askoy." On one route or the other we anchored, dredged, or made use of our diving outfit in the bays of Guayabo, Ardita, Coredó, Aguacate, Cupica, Solano, Utria, and Cuevaite. But I can do no more than set down, almost at random, impressions of what this rarely visited and only half-charted coast had to offer.

The hidden character of some of the inlets was responsible for much of their allure. A vessel might sail daily past the *Ensenada de Guayabo* without its crew ever realizing that beyond the turn of a point lay a circular basin, with ample depth and perfect shelter, where the sun could not peep above the mountains until 50 minutes after it had technically risen, and where clumps of tropical fruits throve in close proximity to the coconut palms of the landing. A more eye-satisfying little Eden would be hard to imagine in all the world. On the promontories sticking forth from the surrounding hills, the rain forest thinned out into trees filled with "witches' brooms" of orchids and other

epiphytes, and on each rocky point, close to the spray, a spreading frangipani stood like a candelabra of white blossoms and spread its faint perfume down the wind.

Aguacate Bay, which runs northward behind the shelter of Point Marzo, is larger and grander and more exposed, though with the same air of being unmarred since the creation of the world. On the afternoon of March 6 we rounded, in heaving and foamy water, the string of rocky islets that forms the tip of the point. These rocks were covered above the spray line with a trailing fleshy-stemmed cactus that produces one of the most delectable of tropical American fruits. The white water around the ledges and caves was alive with birds, including Colombian boobies, cormorants, and pretty rafts of black terns weathercocking to the wind. Perched on the pinnacles were winter tourists to the tropics, namely, duck hawks, which from time to time darted forth to capture the lesser fowl that made up their prey. The only time in my life that I ever saw a black tern actually dive into water was when a duck hawk singled it out from its group and attempted to strike it down.

After a night close to the western shore of Aguacate Bay, where the trees were starred with brilliant and enormous fireflies, I undertook a little reconnoitering in the skiff and followed the bends of the shoreline out to Point Marzo. It was an entrancing coast. The effect of the all but impenetrable forest showed in the number of brooks dashing down to the bay. I assumed that these were perennial, despite the considerable length of the dry season and the narrowness of the ridge in which their sources lie. I found also five spouting caves under the foundations of the ridge. Swells rolling in from the Pacific, closing an inner entrance and compressing the air, resulted in a blow-off, in some cases 30 feet high, that sounded like a whole school of whales.

At tip of the cape, eroded stacks were connected by a bar that was mostly submerged, and this divided bay from ocean. A steep surf thundered ashore and washed through to the little cove in which I bobbed in the skiff. The force of the waves was so completely broken by the bar, however, that I could watch rollers higher than my head race forward as if to

swamp me, only to crash 40 feet away.

Puerto Utria, which lies at the northern end of the Gulf of Tibugá, within sight of the conical mountains on Cape Corrientes, is even more thoroughly concealed than the cove of Guayabo Chiquito. In fact, Utria was the last harbor added to the map of tropical America because it was unknown to geographers until discovered by the British surveying ship, "Pandora," in 1848. When we approached the coast on May 14, after returning from a transect out to sea, it was easy to understand why mariners had missed Puerto Utria for the first three centuries of European voyages along this coast. Point Solano to the north, and Cape Corrientes to the south, reach seaward as two great salients. Seafarers would naturally lay their course from one of these to the other, avoiding the curved indentation between them, which has nothing to recommend it and which is often a dangerous lee shore. That is, it has nothing to recommend it except Puerto Utria, which is so tucked away that its presence could hardly be suspected from a mile off.

When we entered Puerto Utria an exceptionally large display of flying fish broke the surface, and a milk-white cotinga resembling the "dove of peace" called a welcome from the tip-top of a tree. There was nothing particularly marine about the appearance of the long fiord except the luxuriant groves of coconut palms on one shore. Rather, the whole setting looked like a tropical version of Lake George. The hills, smothered under primeval forest, rose steeply on either side, marked here and there by the red scars of landslides. The sub-surface slope was also abrupt, for our soundings showed depths of more than ten fathoms within a ship's length of the beach. We dredged both in and out before coming to anchor off the inhabited sand spit. The bottom proved muddy and unfruitful, perhaps because of the great deposits of vegetable debris that covered it.

In afternoon Comandante Fallon and I went a-pioneering on the ridge forming the western side of Puerto Utria. We penetrated the rain forest by following brook beds and the trails made by wild animals. At some places we had to hack our way with machetes, and we were always careful to leave blaze marks at reasonable intervals. Part of our struggle included the climbing of waterfalls, and



◀ THE SOUTHERN TIP OF CAPE CORRIENTES, against the sunset. This cape is the most imposing salient that extends into the ocean on the Pacific coast of Colombia



▲ A BROWN PELICAN, white-eyed and solemn-looking, contemplates the leader of the "Askoy" Expedition, who is passing in his skiff along the rocky and heavily forested shore of Aguacate Bay



◀ AN ANCHOR CHAIN dredged from the bottom of the Bay of Solano. Historians in Colombia say that it dates from the early part of the 16th century, when Francisco Pizarro and his fellow conquistadors battled weather and savages along the Chocó coast on their way toward the then unknown empire of the Incas

under one of these we enjoyed a luxurious bath and shampoo shortly before our return to the beach. My previous woodland rambling in the Chocó had been confined to the island of Gorgona. This first mainland journey was even more fascinating because the forest was of richer variety and more flowers were in blossom, whether of tree, shrub, or herb. Animal life was also more conspicuous, although we encountered no snakes. These are the bane of Gorgona, where, as it occurred to me, there are no peccaries to hold down their numbers. Honeycreepers buzzed about in the gloom under a forest crown that was all ablaze with the sun on its upper side. Laughing-hawks followed us about and seemed to chortle at our expense when we hooked ourselves in some tangle. Lizards with casques on their heads pecked at us and then vanished around the boles of trees. Along the edges of the brooks were numberless pairing frogs, the females about an inch in length, and the clasping males not more than one-quarter the bulk of their partners. Both bore on their moist skins an intricate and bizarre pattern of black and yellow markings.

Most conspicuous and startling of all the forest people, however, were land crabs of the genus *Geocarcinus*



▲ NARROW BUT DEEP PUERTO UTRIA is sheltered from all winds and concealed so that its existence could hardly be suspected from the ocean. Thus it offered "Askoy" one of her snuggest berths along the Baudó Mountain coast

➤ NICOLAS ELADIO LEMOS, patriarch of the Puerto Utria settlement and father of fourteen living sons. He seemed uncertain about the number of his daughters



which measured perhaps four inches across the breadth of their backs. These rattly creatures were nothing short of uncanny in their ubiquitous presence. They scattered before us at almost every footstep and it was not unusual to take in 50 or more at one glance, all sidling or backing away from my companion and me. We pinned down several in order that they might be securely grasped while I wrote in my notebook exactly what the gaudy brutes looked like. The description may be worth recording: "a purple-black carapace, with inconspicuous stalked eyes of the same hue; behind and outside each eye is a large spot of brilliant orange which simulates an eye and which looks weird and baleful in the dim light; the formidable claws are violet-purple, blending into pale porcellaneous tips, and the four pairs of legs upon which the creatures scuttle are clear coral-red; just behind the middle of the carapace are two white spots, the hinder edges of which are scalloped with patches of orange and red, which last two colors prevail on the under surface."

This crab is only one of several found in the Chocó. At the public market of Tumaco we purchased examples of a kind that wore only two colors—Prussian blue and carmine. "A sport-model," is what Comandante Fallon called it.

The land crabs range miles inland, but they all return annually to breed in their ancestral ocean home. The migration begins near the end of the

dry season. In Panama this means the latter part of Lent, whence the tradition that the crabs are bent upon joining the Good Friday procession. Their pious motive does not deter the human population from capturing and eating vast numbers of them. At the time of the great marches, it is said that the world goes alive with crabs and that the forest floor sounds as though it were being whipped by hail.

From our Puerto Utria anchorage we had a close view of the scene ashore. Near the tall coconuts were other culture plants, including oranges, limes, aguacates, taguas (ivory nuts), and *chontaduros* or the fruit of the widely useful palm known as the *chonta macana*. The people, who preserved a friendly reticence toward our visiting craft, were Negroes or mulattoes. A man and woman paddled home in a cayuco, their dog between them, and the woman carried up to the house an armadillo that the dog had nosed out for the family larder. It is no trick to capture these mammals if you meet them. The only one I saw alive was a dull, glassy-eyed, expressionless little beast, which jogged ahead unhurriedly and uttered plaintive grunts when seized. I put it on the earth beside an ant hill and it dug in rapidly, with wide scoops of the claws, but it seemed to possess no other means of escape.

Comandante Fallon, a naval man with an eye to the future, had taken out a land claim at Puerto Utria, where the local patriach, Nicolás Eladio Lemos, was his "agent." On

the morning after our arrival we went ashore to meet this grizzled and bearded Negro, who was the personification of bare-footed dignity. He reminded us of *El Jamaicano* in that he, too, had recently recovered from the bite of a serpent, which he called a *dormilona* ("sleepy head"). He invited us to the porch of his palm-thatched ménage, where we found sundry women and children and five lean dogs. A few of the old man's fourteen sons dwelt in the neighborhood, but most of them were seeking their fortunes in Panama. "*A sus órdenes*" (At your orders) was the greeting from all hands.

I spoke to a young woman holding a baby about the extraordinary beauty of the view down the fiord, where distant Mt. Ananá, on Cape Corrientes, was framed between trees of the narrow entrance. "Very pretty, but devilish lonely," was the gist of her reply.

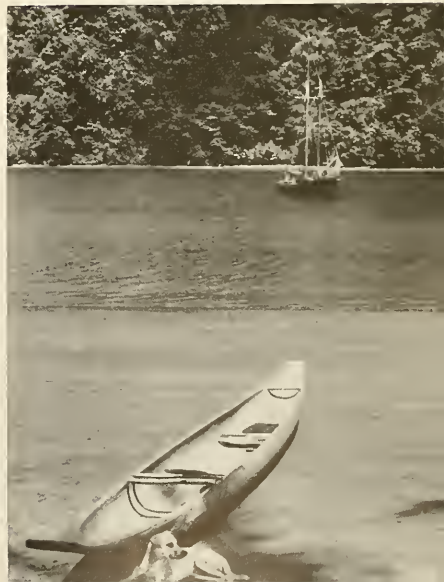
As overseer of Fallon's property, old Lemos rendered a written bill for services on the evening before "Askoy's" departure. It contained no monetary items but requested payment in Singer sewing machine needles, fishhooks, aspirin, iodine, bandages, etc. We honored it in so far as we were able, and threw in a Cali cheese. Don Eduardo promised to pay the balance on the occasion of his next call in the gunboat "Junin," which he commanded. Lemos thereupon sent us a farewell gift of fruit, which included the biggest papaya I had ever seen.

(To be continued)

▼ THE SAND SPIT AND COCONUT GROVE at Puerto Utria. This view looks northward up the narrow fiord. Puerto Utria was the last inlet added to the map of tropical America, for it was not discovered until 1848



► THE HOUR OF SIESTA in Puerto Utria, when even the dogs seek the shade: a scene looking westward from the small Negro community toward the wild and wooded peninsula beyond



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WELL WELL WELL

Continued from page 455

It hardly seems possible that so much pressure can exist to force such a volume of water from the earth. Geysers, of course, are periodic and owe their pressure to the accumulation of steam. Artesian wells derive theirs from a weight of water impounded in sloping layers of rock.

The strangest well I have ever seen is one that I like to call my "ink well." This well, located in Milwaukee, had gushed from a depth of 1600 feet for many years. Then its water became highly mineralized, and I was called in to see whether it might be possible to redeem it by taking water from some other depth. To the amazement of all, the well broke through a crust at the bottom of the old 1600-foot depth, and for two days volumes of black ink flowed forth.

We knew that the Creator never deposited a large reservoir of genuine ink 1600 feet below the surface, but it would have been difficult to guess the true explanation.

Close to the casing wall a tannic acid pipe line had, in the course of many years, sprung a leak, permitting the tanning chemicals to trickle down along the casing walls. Since this water ran very high in both iron and lime, it had formed the ink solution, which had accumulated in a large cavity at the bottom. It had crusted over, thus preserving the ink until the drill broke through. The well was plugged back around 1200 feet and yielded excellent artesian water, which has been used in the tanning factory ever since.

Nature sometimes seems extravagantly generous, sometimes grasping. Along the Snake River in Idaho there is a series of springs which yield enough water to supply every city in the United States of more than 100,000 population with 100 gallons of water a day per person. Elsewhere, alfalfa sometimes has to send its roots down 65 feet to get enough water to keep alive. And what might be called the opposite of an artesian well was encountered near Staunton, Virginia. A large reservoir was built, and when the dam was completed, the basin for holding the stream water was quickly filled. To the great surprise of the city officials, the reservoir was no sooner flowing over the spillway than the entire water suddenly disappeared. It had found an underground channel in the cavernous limestone underlying the region. You never can be quite sure.

BOOKS

Continued from page 439

sequently there have been woven into the story the lives and work of many times nineteen scientists. The book closes with a chapter on the future of Science in America.

Mr. Jaffe is Head of the Physical Science Department in New York City's Bushwick High School. He is no doubt primarily a chemist since he is the author of textbooks on chemistry. As a popularizer of science he attracted attention by the publication of *Crucibles*, which won the Francis Bacon award for the Humanizing of Knowledge in 1930. His *Outposts of Science* was a Scientific Book Club selection in 1935. His new book, *Men of Science in America*, is also a selection of the Scientific Book Club.

CLYDE FISHER.

THE UNIVERSE AROUND US

----- by Sir James Jeans

4th Edition

Macmillan Co., \$3.75, 32 plates, 297 pages

TEN years have passed since the appearance of the third edition of Sir James Jeans' greatest book. The advance in our knowledge of the physics of atomic nuclei during this time has been so far-reaching that the author has rewritten a large part of the book and has revised most of the remainder.

No astronomer who writes in English is better able to make abstruse facts of astronomy and physics clear, interesting,

and dramatic than the present author. A large number of lay readers as well as teachers of astronomy will welcome *The Universe Around Us* brought up to date. The chapter on the origin of the Solar System has been amended, but that subject seems to be as uncertain as ever. Such subjects, however, as the age of the Earth and the evolution of the Sun show greater progress.

The book is sprinkled with comparisons like the following: "Empty Waterloo Station of everything except six specks of dust, and it is still far more crowded with dust than space is with stars." These arresting statements stick in one's mind and do much to aid one in his struggle to comprehend the vastness of the universe.

CLYDE FISHER.

YOUR SERVANT, THE MOLECULE

----- by Walter S. Landis

The Macmillan Company, \$2.75

13 illustrations, 238 pages

WE have become so accustomed to accept as natural the myriad things produced by the industry that furnishes us with the ordinary necessities and comforts of life that we seldom pause to consider that they are the result of an enormous amount of research. Even the simplest of things, foodstuffs and clothing, have been improved, and the improved articles are available at no increase in cost. Indeed, improvements in the technique of manufacturing have generally



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COLOR PROCESS, BLACK AND WHITE, BEN DAY, LINE

Above Illustration: Part of Plains Group, American Museum of Natural History. Photo by T. L. Bierwert and C. H. Coles



resulted in reduced prices. Millions of hours of research are often required for the production of a single product. It took ten years of research to produce nylon—a product having much finer qualities than silk and one which will replace it, except for those who insist upon a material that has become classic because it was once so rare that only the very wealthiest could afford it.

Doctor Landis has handled an extremely difficult subject in a masterly manner. Chemistry is one of those sciences in which formulae, full of meaning to a chemist but wholly meaningless to the layman, tell long stories in the fewest possible characters. A number of formulae are employed in the book to illustrate how the chemist works to build useful products from raw materials, but the reader can ignore these and still understand the process.

In each of the chapters there is an historical analysis of the development of the various products, from the original crude form to the highly perfected product of the present time. It is interesting to read of the reasons for the use of wool, cotton, silk, and linen in the manufacture of cloth. The reasons are linked up with their physical qualities. The same qualities must be present in synthetic materials. How these qualities are reproduced is explained in an interesting way.

Doctor Landis' book will prove extremely fascinating to anyone having the slightest desire to know how the commonplace things of our complex economic life originate.

C. H. CURRAN.

ONE DAY ON BEETLE ROCK

----- by Sally Carrighar

Alfred A. Knopf, \$2.75, 20 illustrations, 196 pages

HERE are ten stories, the interwoven tales of mammals, birds, and a lizard. The doings and adventures of these animals and others associated with them during a single June day are described. The scene is Beetle Rock, in the High Sierras of California. The author spent months in this small section of Sequoia National Park watching the animals. The things she was not able to observe at firsthand have been filled in from other sources. The information thus gathered is set down in beautiful and imaginative language.

The behavior of the various animals, a weasel and her young ones, a Sierra grouse, a chickaree, a mother bear and her cubs, a fence lizard, coyotes, a deer mouse, a Steller jay, and an aging mule deer buck, is described with an understanding sympathy in each case. It is highly commendable that this author is able to take the common actions and reactions of animals and invest them with attractiveness and interest.

In most cases she does this without sacrificing the truth, but there are numerous small inaccuracies. At times the temptation to describe what might occur as if it did leads her onto uncertain ground. There is a strong flavor of anthropomorphism through much of the writing, but

many fully objective passages are included. Diurnal, easily watched animals are more faithfully portrayed than the secretive, night-loving kinds, as might be expected.

The illustrations are attractive black and white drawings (scratch board), by Henry B. Kane. Two or three of these are not all that might be desired, but others are excellent. It is only fair to commend the publishers for the fine quality of the printing and the clear text.

J. E. HILL.

PATRICK GEDDES, MAKER OF THE FUTURE

----- by Philip Boardman

University of North Carolina Press, \$5.00, 504 pages

IN a biological sketch in *The Nation*, May 4, 1932, S. K. Ratcliffe said: "Patrick Geddes, who died at Montpellier in the south of France April 17, was one of the few men of indisputable genius produced by Britain in our time." Born in the little Scottish town of Perth, his chief interest from boyhood was nature. In 1875 he went to London to study under Huxley, who soon made him his assistant. In fact Geddes is usually considered Huxley's most brilliant student.

Critical of the methods of college and university education, he spurned all degrees; and later, "for democratic reasons," declined the knighthood. In spite of lack of degrees, he was for 31 years part-time Professor of Botany at University College in Dundee. This unusual position as truant botanist gave him time to develop along other lines and to engage in other important enterprises. During the eighteen-eighties, he wrote many major and minor articles for *Britannica* and *Chambers'* on biological subjects, the extent of this intellectual work ranking him as the leading encyclopedist of our times.

As someone has happily phrased it, "Geddes' greatest contribution to biology was J. Arthur Thomson." With this famous student of his he wrote the classic, *The Evolution of Sex*, which shocked the nineties by advocating birth-control. As an old man, only a few years before his death, he wrote with J. Arthur Thomson as co-author, their long-dreamed-of opus, a two-volume study of *Life: Outlines of General Biology*.

Not only was Geddes a great botanist and an inspiring teacher, he was also an expert in sociology, city-planning, reclamation, geography, and economics. He was no superficial student in any of these fields, and much of his tremendous energy and enthusiasm were spent in fields outside of botany. More time was given to cleaning up slums, building co-operative apartment houses, founding student hostels, and criticizing universities than in the classroom. He was the pioneer in "regional surveys." "Study your city's past heritage and present burdens," he said, "before trying to plan her future."

Lewis Mumford has written an appreciative introduction to the biography of this versatile and courageous Scot.

CLYDE FISHER.





